Single Aisle
TECHNICAL TRAINING MANUAL
GENERAL FAMILIARIZATION COURSE - T4 (CFM 56)
PART 1 OUT OF 2

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PART 1 OUT OF 2

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00 FAMILY TIES PRESENTATION (1)

FAMILY TIES

Before we design an aircraft, there are a lot of people we listen to:
- the businessman is interested in saving time,
- the cabin crew want the aircraft to be user friendly,
- the ground crew want easy maintenance,
- the pilot wants the aircraft to be dependable and easy to handle,
- management are interested in the bottom line and our sales team want an aircraft that can go out and beat the competition with.

So when we have done the listening, we started to design a new generation 150 seat. And what we design has been a great success on original lines all over the world.
With the latest electronics Flight By Wire control and a new approach to the man machine interface, the A320 really is the state of the art in commercial aviation. But to the Airbus Industry approach to the success is to go further.
By getting our ideas clear at the design stage we have made the A320 the start of a real family.
For example, to stretch the 150 seat A320 into a 190 seat A321 we have simply to make local re-enforcements to the wing and center section and some minor changes to the flight control software. The rest could stay virtually the same.
The A321 is an A320 with two extra fuselage sections and room for 36 more paying customers.
In the same way we have been able to shorten the A320 to create the A319, the most economic member of the family.
These three aircrafts between them cover the needs of the airlines from 124 to 185 seats.
This family design makes it easier for an airline to cope with daily or seasonal variations in traffic and keep maintenance costs down because of the fleet effect.
COMFORT
The family effect is all the greater because the initial design was right.
For passengers, this means an aircraft that is comfortable and convenient in every class.
The versatility of the single aisle cabin lets operate as to match the market.
First, business or economy class layouts as passenger demand requires.
On regional flights, this means an equal comfort and useful flexibility for the airline.
FLEXIBILITY
The cabin intercommunication system makes it easy to vary cabin configuration.
With the wide aisle, cabin crew and passengers can move more easily.
A standard A321 with 196 passengers has a turn round time of only 34 minutes and this reduces to 29 minutes with the wide aisle option, 11 minutes faster than the competition.
EFFICIENCY
When the baggage isn't left behind, the cargo compartments can be unloaded and reloaded well within the passenger turn round time.
70% of A320 users have opted for the containerization system based on the LD 3 standard. A wise choice when you consider the increasing proportion of an airline income that comes from freight.
Although the A321 is only 18% longer than the A320, its underfloor capacity is 40% greater, room for three more containers.
TECHNOLOGY
Advanced composite materials and the best aluminum alloys produce a rugged yet light airframe. High structural efficiency directly reduces operating costs.
The A321 and A319 are assembled in Germany at a purpose built Deutsch Airbus plant.
Since potential corrosion problems are addressed at source, structural inspection programs are simplified reducing maintenance costs and enhancing resell value.
More advanced technology can be seen in the wings which are lighter and optimized for computer control flight. Because of better

aerodynamics, they made the A320 and the A321 the most fuel efficient commercial jets on the market.

RANGE

The Airbus A321 cost per passenger mille is by far the lowest in its category.

The A319 has the lowest fuel consumption.

The engines too interface with the flight by wire controls and the autopilot system.

The whole family has the same man machine interface. The Primary Flight Display alone replaces six conventional electromagnetic instruments.

Information is displayed on a six cathode ray tubes when it is needed, thus reducing the crew's workload.

A major asset of computer-aided design is ease of access to system operation parameters. This is an advantage for the Centralized Fault Display System (CFDS), the key to maintenance guidance.

Any failure is analyzed, the faulty component identified, the diagnosis made, and if necessary the information is transmitted to the ground in real time for time saving repair.

The A320 family ties really come into their own when it comes to maintenance. Virtually all despairs, test devices and procedures are identical. No need for extra stocks or special training or facilities in service staff are available for the whole family.

FLEET ADVANTAGE

In terms of maintenance operating A320s, A321s and A319s is the same as operating a single type. The savings are enormous, common equipment, common staff.

For cabin crew, the cabin is a just a little longer or shorter.

For pilots the aircraft are virtually the same. They react in the same way to the same commands. This is true of all Airbus Industry new generation aircraft from the A319 to the four engine A340.

The simulator is common to the whole family. Basic crew conversion costs are therefore much lower for airlines, which base their fleets on Airbus technology. Because the crews can be used on different aircraft, operations are more flexible and efficient.

Designing a 192/200 seater based on the A320 was a natural step. The cost effectiveness of the idea is even clearer in market forecast.

The advent of the A319 is perhaps even more inhibitive. Now airlines can adapt a slack operating periods and expand their commercial networks to second relines while keeping the fleet effect.

The A319 opens up development perspectives for smaller airlines too by providing them now with a high quality aircraft that would go on being attractive.

By founding the first real family of aircraft, Airbus Industry has created a novel concept based on standardization and maximum commonality.

We have provided the market with three cost effective aircrafts, which operate efficiently together.

This family works as a team.

FAMILY TIES

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00 FAMILY TIES PRESENTATION (1)

A320 FAMILY

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A320 FAMILY

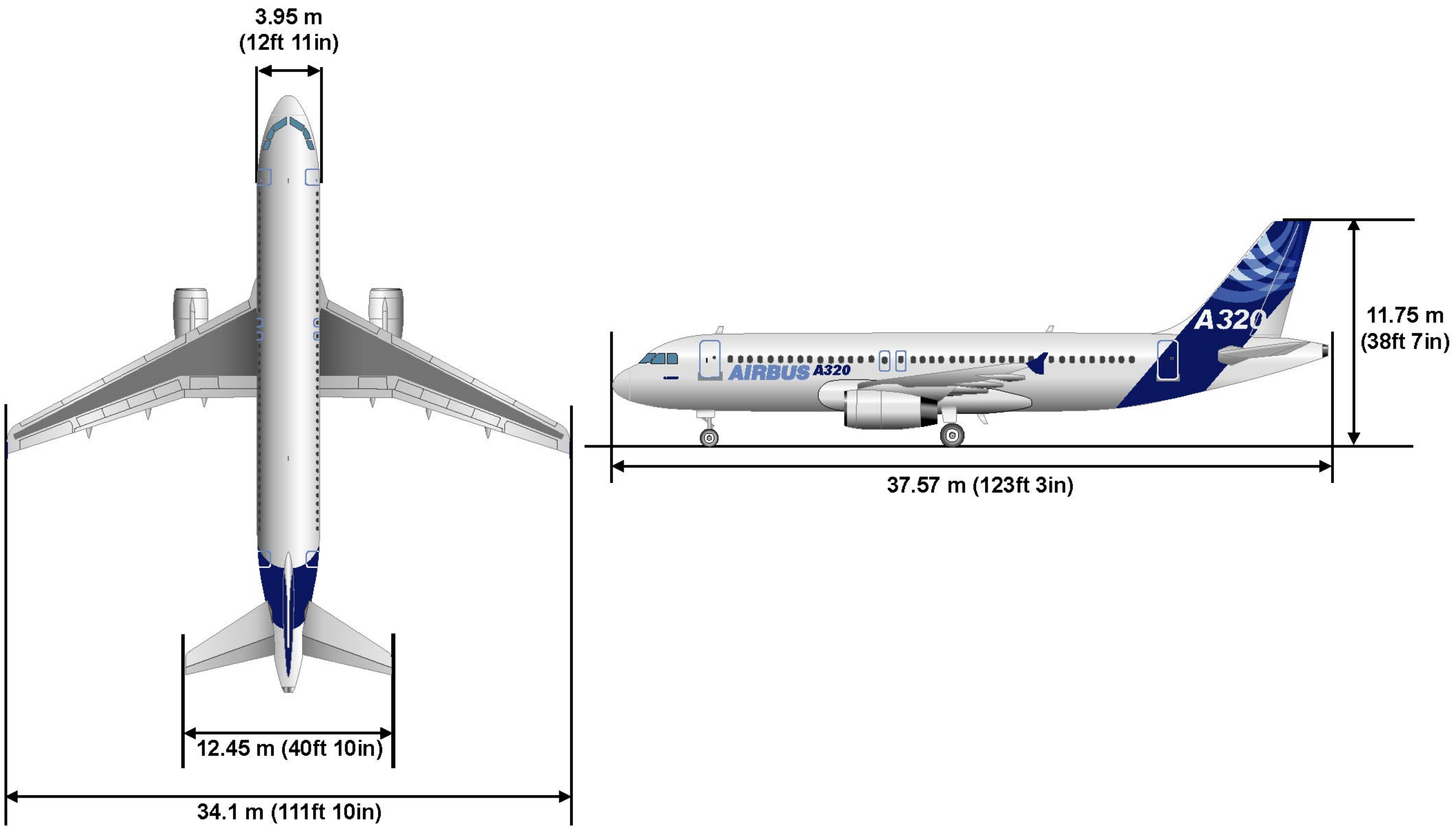
00 SA FAMILY PRESENTATION (1)

AIRCRAFT GENERAL

The Single Aisle is the most advanced family aircraft in service today, with fly-by-wire flight controls.
The A318, A319, A320 and A321 are twin-engine subsonic medium range aircraft.
The family offers a choice of engines:
- International Aero Engines and CFM International for the A319, A320 and A321.
- Pratt & Whitney and CFM International for the A318.

AIRCRAFT DIMENSIONS

The picture shows the main dimensions for the A320.
The A318, A319 and A321 have exactly the same dimensions except that:
- the A318 is 6.12 m (20 ft) shorter and 1.18 m (3ft 10in) higher,
- the A319 is 3.74 m (12ft 3in) shorter,
- the A321 is 6.93 m (22ft 9in) longer.



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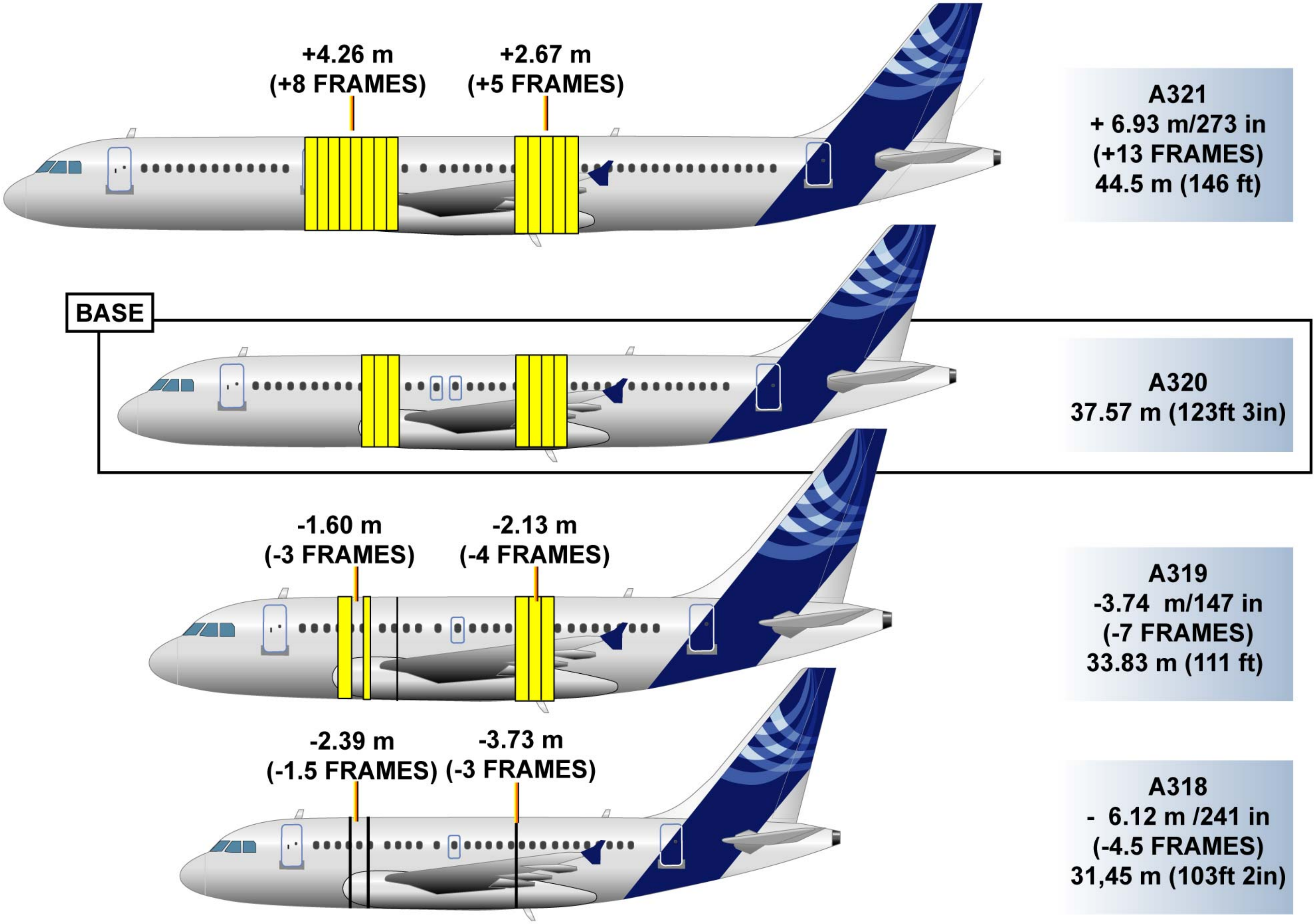
AIRCRAFT GENERAL - AIRCRAFT DIMENSIONS



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AIRCRAFT GENERAL - AIRCRAFT DIMENSIONS

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00 SA FAMILY PRESENTATION (1)

AIRCRAFT GENERAL (continued)

FAMILY RANGE

With a Maximum Take-Off Weight (MTOW) of 77 tons (170000 lbs), the A320 has a range of 3600 Nm as shown above.
- For the A318, with an MTOW of 66 tons (145500 lbs), it is 3900 Nm.
- For the A319, with an MTOW of 68 tons (150000 lbs), it is 4200 Nm.
- For the A321, with an MTOW of 83 tons (183000 lbs), it is 3100 Nm.

WITH AN MTOW OF 77 tons (170 000 lbs), THE A320 HAS A RANGE OF 3600 Nm AS SHOWN ABOVE.

- FOR THE A318, WITH AN MTOW OF 66 tons (145 500 lbs), IT IS 3900 Nm.
- FOR THE A319, WITH AN MTOW OF 68 tons (150 000 lbs), IT IS 4200 Nm.
- FOR THE A321, WITH AN MTOW OF 83 tons (183 000 lbs), IT IS 3100 Nm.

MTOW: Maximum Take-Off Weight

AIRCRAFT GENERAL - FAMILY RANGE

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00 SA FAMILY PRESENTATION (1)

AIRCRAFT GENERAL (continued)

MAXIMUM WEIGHTS AND OPERATING LIMITS

The following picture shows maximum weights and operating limits for the Single Aisle family aircraft.

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MODEL	ENGINE		MAXIMUM WEIGHTS (kg)			OPERATING LIMITS	
	MANUFACTURER	TYPE	Max Take-Off Weight (MTOW)	Max Landing Weight (MLW)	Max Zero Fuel Weight (MZFW)	Match Max Operating Speed (MMO)	Maximum Operating Speed (VMO)
A318-100	CFMI	CFM56-5-B	FROM 59000 TO 68000	FROM 56000 TO 575000	FROM 53000 TO 54500	0.82	350 kt
	PW	PW 6122					
A319-100	CFMI	CFM 56-5A CFM 56-B	FROM 64000 TO 75500	FROM 61000 TO 62500	FROM 57000 TO 58500		
	IAE	IAE V2522 IAE V2524 IAE V2527					
A320-100	CFMI	CFM56-5A	68000	63000	59000		
A320-200	CFMI	CFM 56-5A CFM 56-5B	FROM 73500 TO 77000	FROM 64500 TO 66000	FROM 61000 TO 62500		
	IAE	IAE V2527 IAE V2500					
A321-100	CFMI	CFM56-5B	FROM 83000 TO 85000	FROM 73500 TO 75000	FROM 69500 TO 71000		
	IAE	IAE V2530					
A321-200	CFMI	CFM56-5B	FROM 89000 TO 93000	FROM 75500 TO 77800	FROM 71500 TO 73800		
	IAE	IAE V2533 IAE V2530					

AIRCRAFT GENERAL - MAXIMUM WEIGHTS AND OPERATING LIMITS

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00 SA FAMILY PRESENTATION (1)

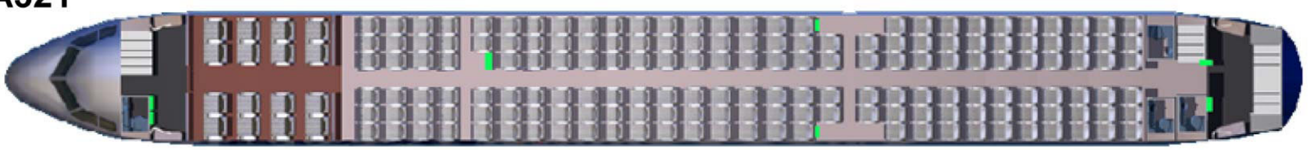
AIRCRAFT GENERAL (continued)

THE CABIN

Cabin seat layout shown in the graphic is the Airbus recommended seat quantity and pitch based on the design of the airframe. Normally the Airline, based on needs, modifies these layouts.

The cabin has a maximum of:
- 129 seats for the A318,
- 145 seats for the A319,
- 180 seats for the A320,
- 220 seats for the A321.

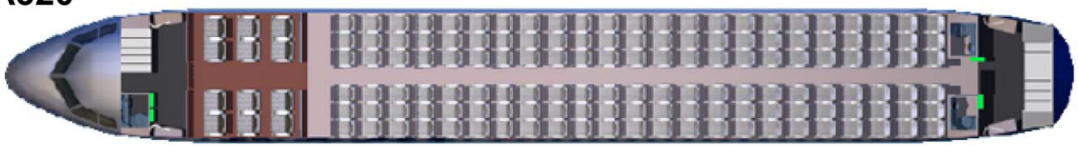
A321



16 FIRST CLASS + 169 ECONOMY = 185 SEATS

SEAT PITCHES: FIRST 0.91 m (36 in)
ECONOMY 0.81/0.79 m (32/31 in)

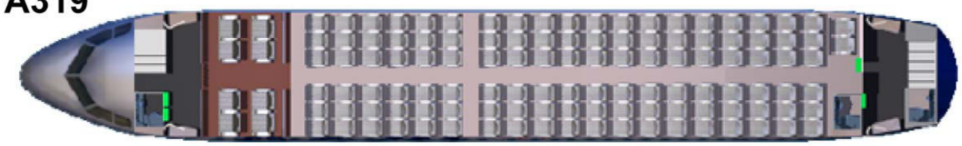
A320



12 FIRST CLASS + 138 ECONOMY = 150 SEATS

SEAT PITCHES: FIRST 0.91 m (36 in)
ECONOMY 0.81 m (32 in)

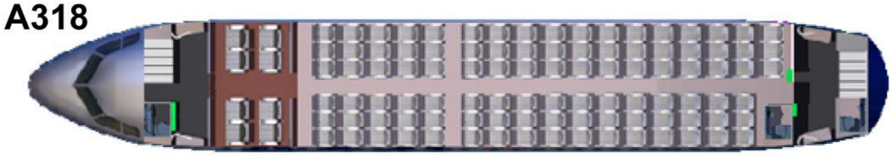
A319



8 FIRST CLASS + 116 ECONOMY = 124 SEATS

SEAT PITCHES: FIRST 0.91 m (36 in)
ECONOMY 0.81 m (32 in)

A318



8 FIRST CLASS + 99 ECONOMY = 107 SEATS

SEAT PITCHES: FIRST 0.91 m (36 in)
ECONOMY 0.81m (32 in)

AIRCRAFT GENERAL - THE CABIN

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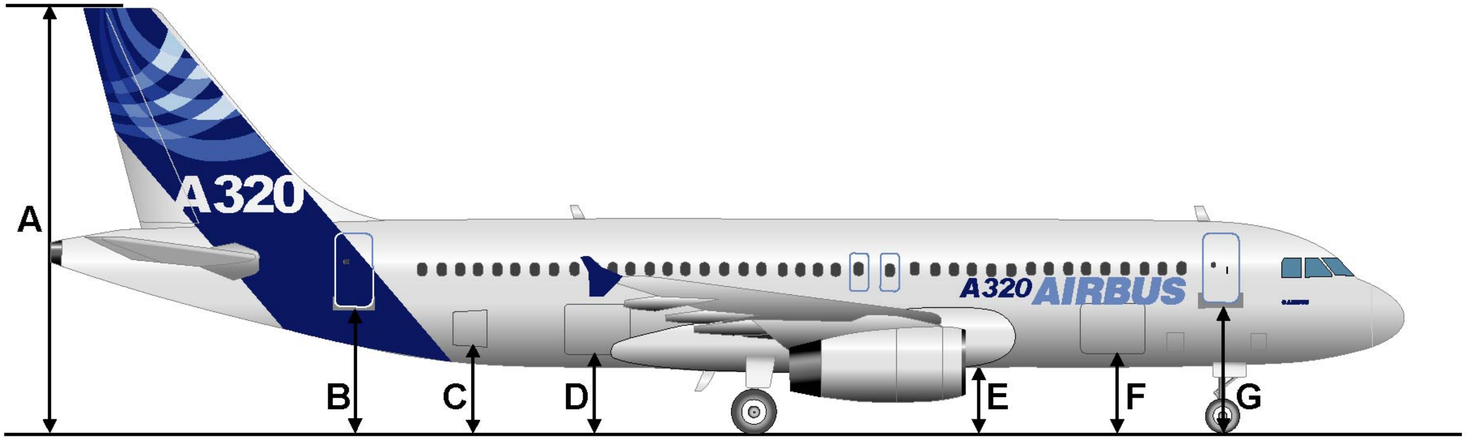
00 SA FAMILY PRESENTATION (1)

AIRCRAFT GENERAL (continued)

DOOR HEIGHTS

The following picture shows the different door heights.



	METERS	FEET	
A	12.14	39ft 10in	MAXIMUM HEIGHT FOR A319/A320/A321
	12.93	42ft	MAXIMUM HEIGHT FOR A318
B	3.73	12ft 03in	AFT PASSENGER DOOR
C	2.51	8ft 03in	BULK CARGO DOOR (OPTIONAL)
D	2.25	7ft 05in	AFT CARGO DOOR
E	1.86	5ft 08in	MAXIMUM FUSELAGE CLEARANCE
F	2.09	6ft 10in	FORWARD CARGO DOOR
G	3.47	11ft 05in	FORWARD PASSENGER DOOR

AIRCRAFT GENERAL - DOOR HEIGHTS

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00 SA FAMILY PRESENTATION (1)

AIRCRAFT GENERAL (continued)

COMPOSITE STRUCTURES

The picture shows the composite structures included in Single Aisle family aircraft.

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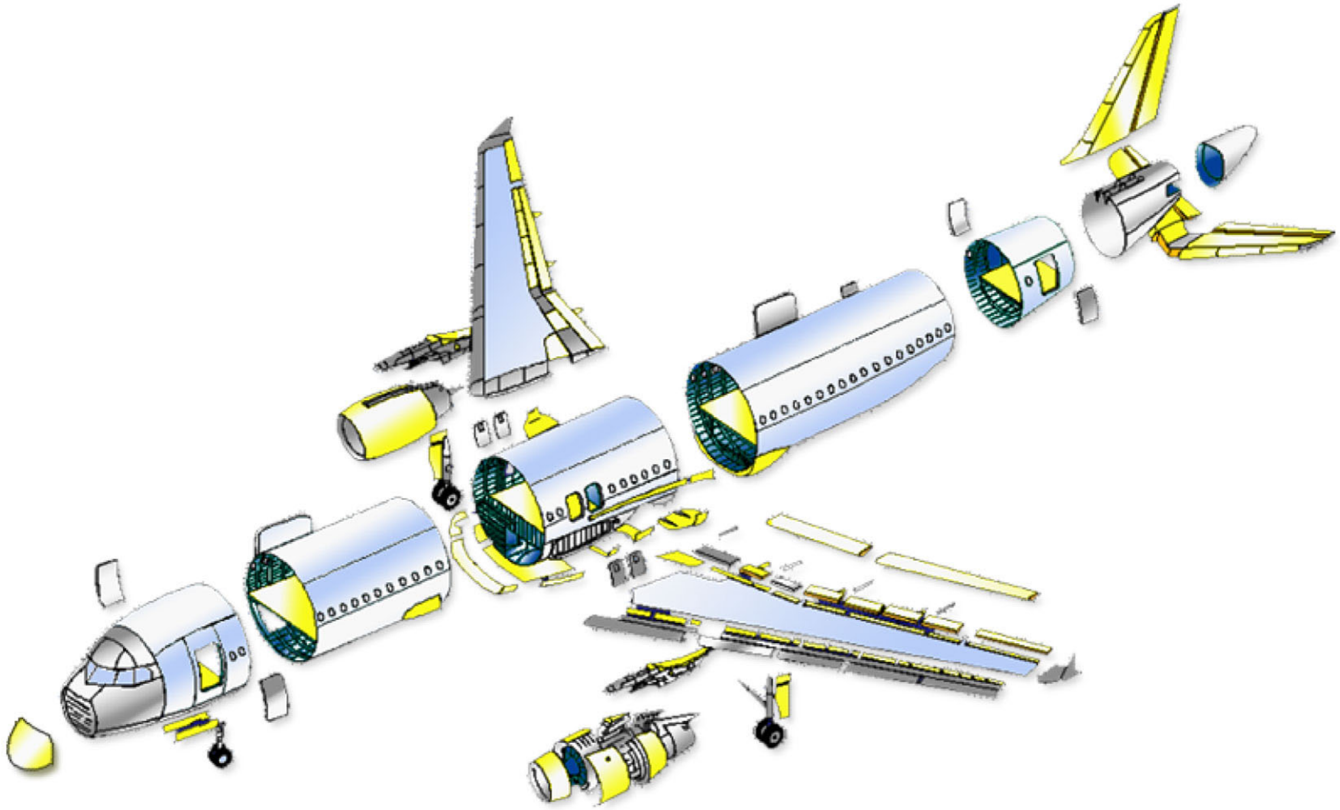


AIRCRAFT GENERAL - COMPOSITE STRUCTURES

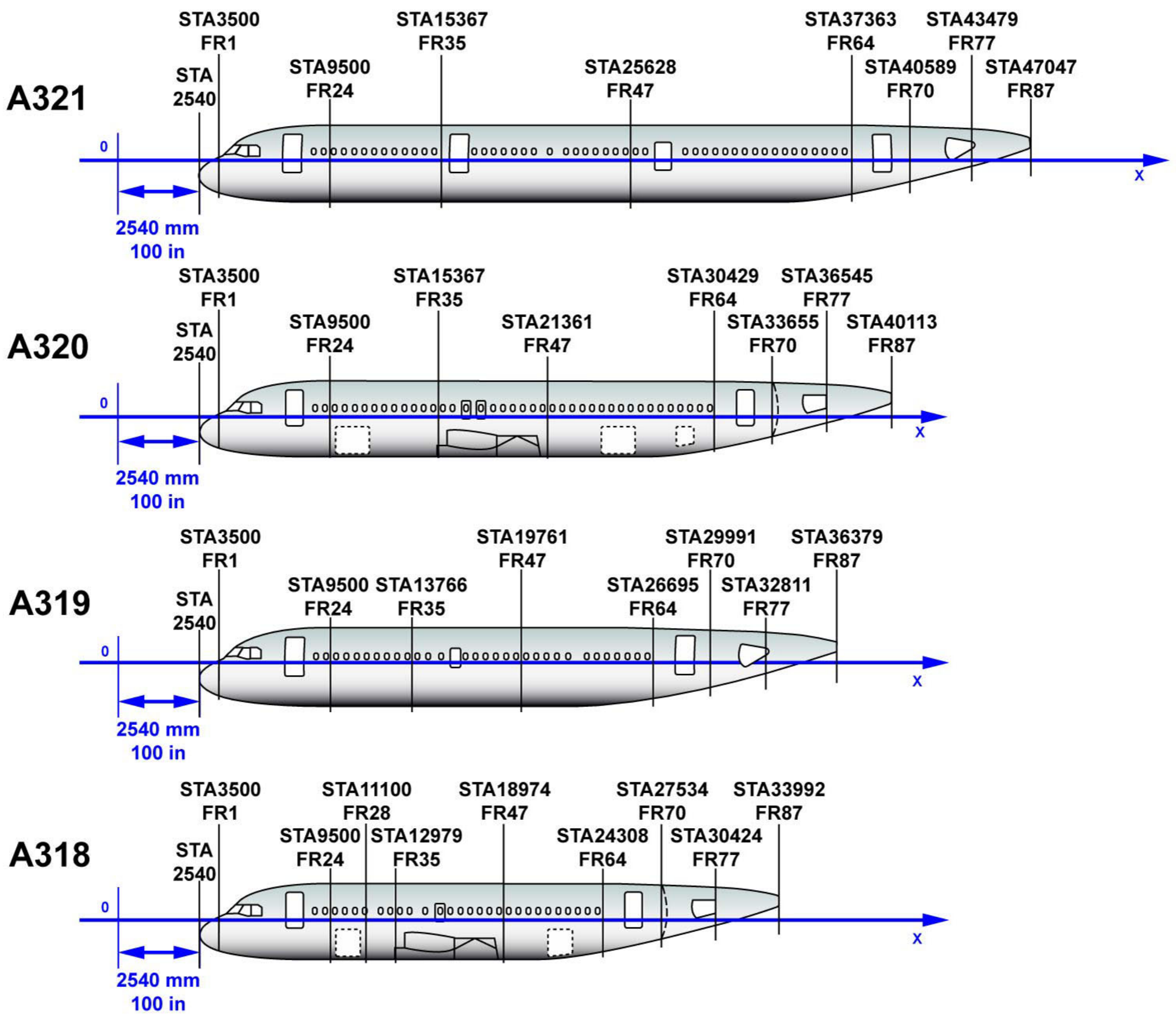
00 SA FAMILY PRESENTATION (1)

STRUCTURAL BREAKDOWN AND ZONING

In this topic, the fuselage, vertical and horizontal stabilizers, and wings station numbers are shown.

FUSELAGE

The station (STA) number is the distance in millimeters of the cross-section from a reference point. The reference (X=0) for all structural measurements in the X-axis is located 2.54 m (100 in) forward of the aircraft.



STRUCTURAL BREAKDOWN AND ZONING - FUSELAGE

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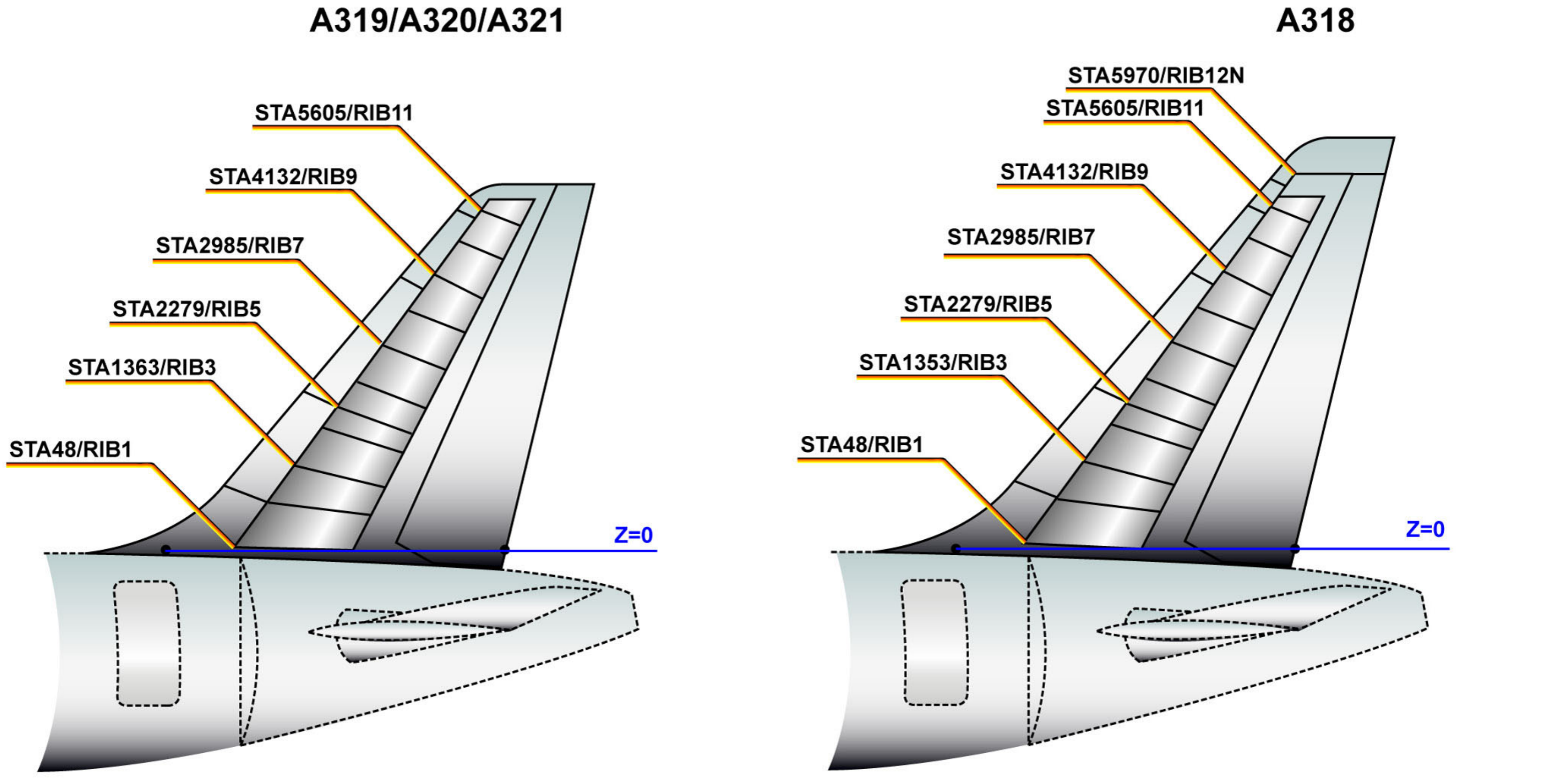
00 SA FAMILY PRESENTATION (1)

STRUCTURAL BREAKDOWN AND ZONING (continued)

VERTICAL STABILIZER

For the vertical stabilizer the reference station is Z=0 at the vertical Z-axis. Due to the fin tip extension, the A318 station numbers have changed. The new rib 12N is on the STA5970.



STRUCTURAL BREAKDOWN AND ZONING - VERTICAL STABILIZER

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00 SA FAMILY PRESENTATION (1)

STRUCTURAL BREAKDOWN AND ZONING (continued)

HORIZONTAL STABILIZER

For the horizontal stabilizer the reference station is Y=0 at the horizontal Y-axis.

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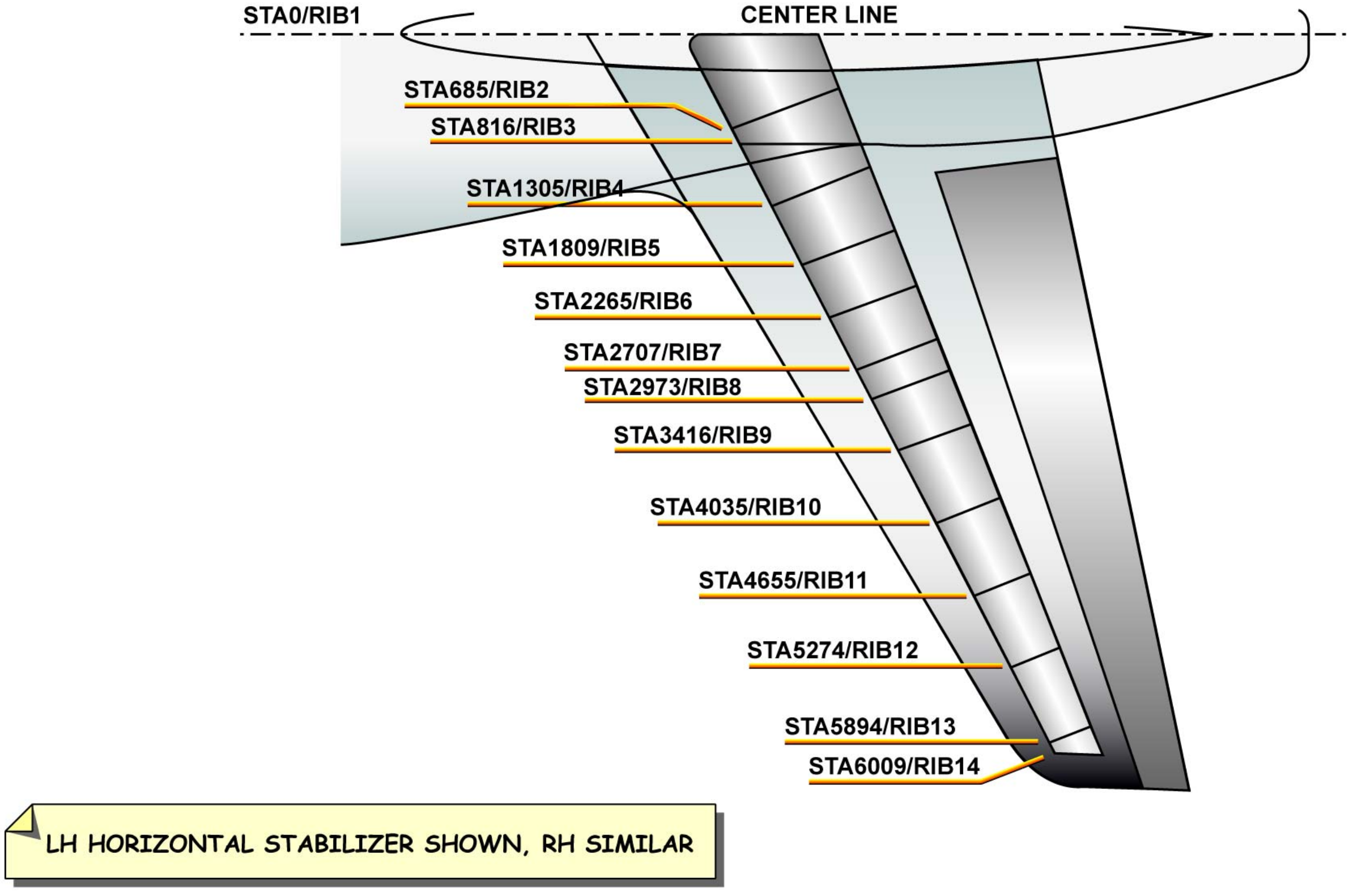

STRUCTURAL BREAKDOWN AND ZONING - HORIZONTAL STABILIZER

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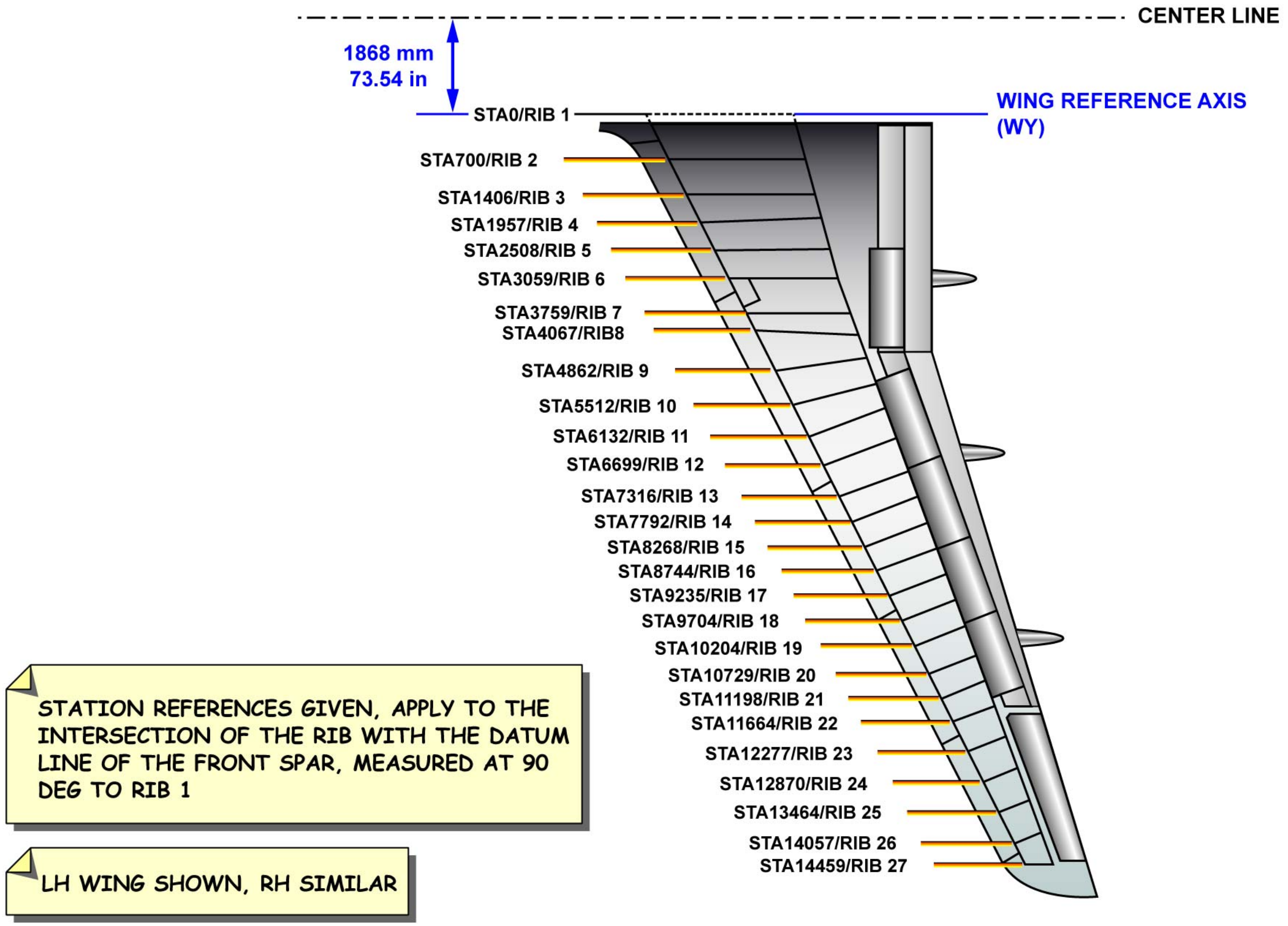
00 SA FAMILY PRESENTATION (1)

STRUCTURAL BREAKDOWN AND ZONING (continued)

WING

For wings, the reference station is the wing reference axis that is located at 1868 millimeters (73.54 in) from the aircraft X-axis.



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STRUCTURAL BREAKDOWN AND ZONING - WING

00 SA FAMILY PRESENTATION (1)

COCKPIT PRESENTATION

The cockpit has adjustable seats for two crew members, a third occupant seat and, depending on the configuration a folding seat for a fourth occupant. Various furnishings and equipment are installed in the cockpit for the comfort, convenience and safety of the occupants.

COCKPIT PRESENTATION

U7Z08431 - U0OT4T0 - UM00PY000000001

00 SA FAMILY PRESENTATION (1)

COCKPIT PRESENTATION (continued)

OVERHEAD PANEL

The controls of most aircraft systems are located on the overhead panel.
The overhead panel is divided into two main sections:
- a FWD section including the system panels,
- an AFT section including mainly the circuit breaker panel.

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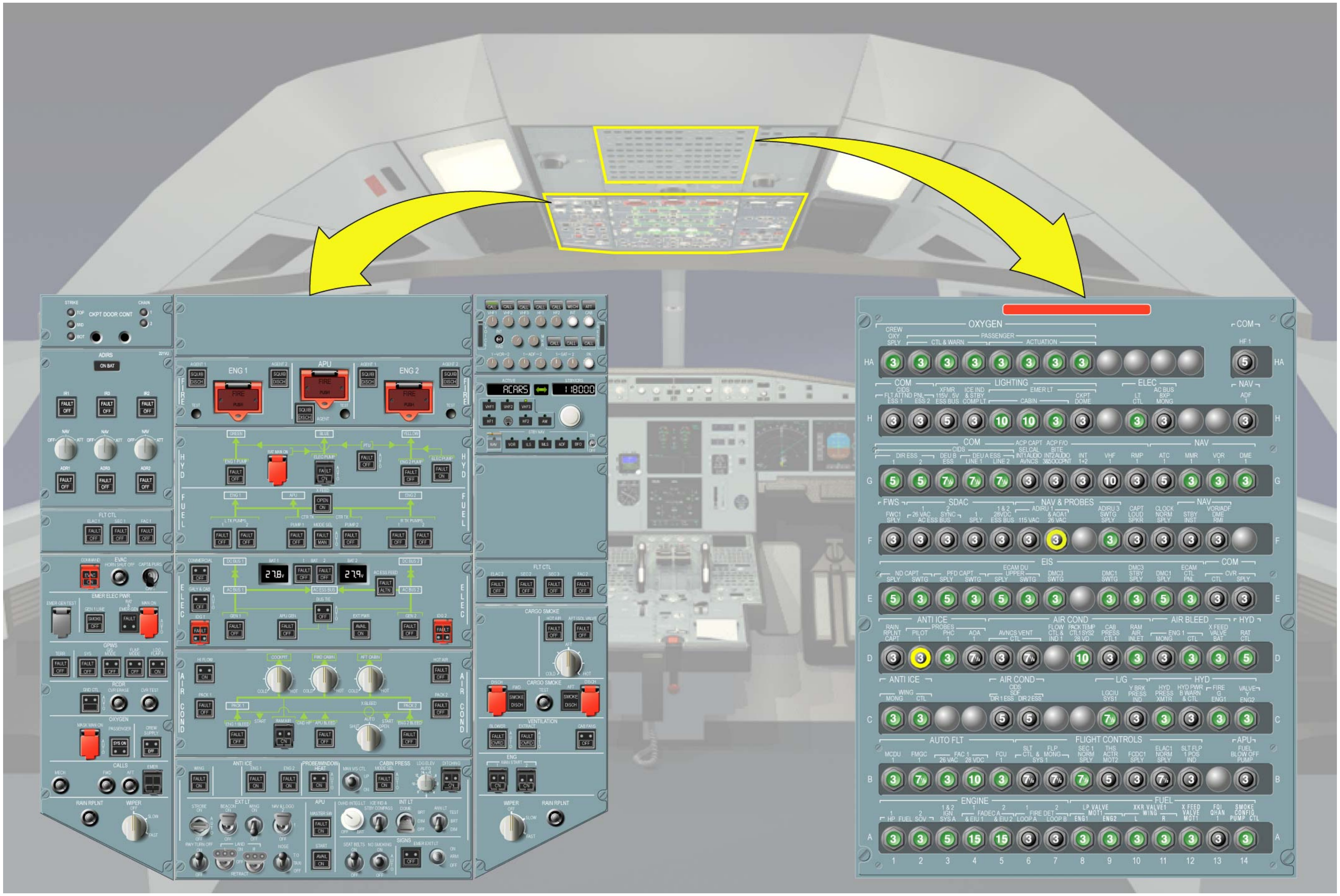


COCKPIT PRESENTATION - OVERHEAD PANEL

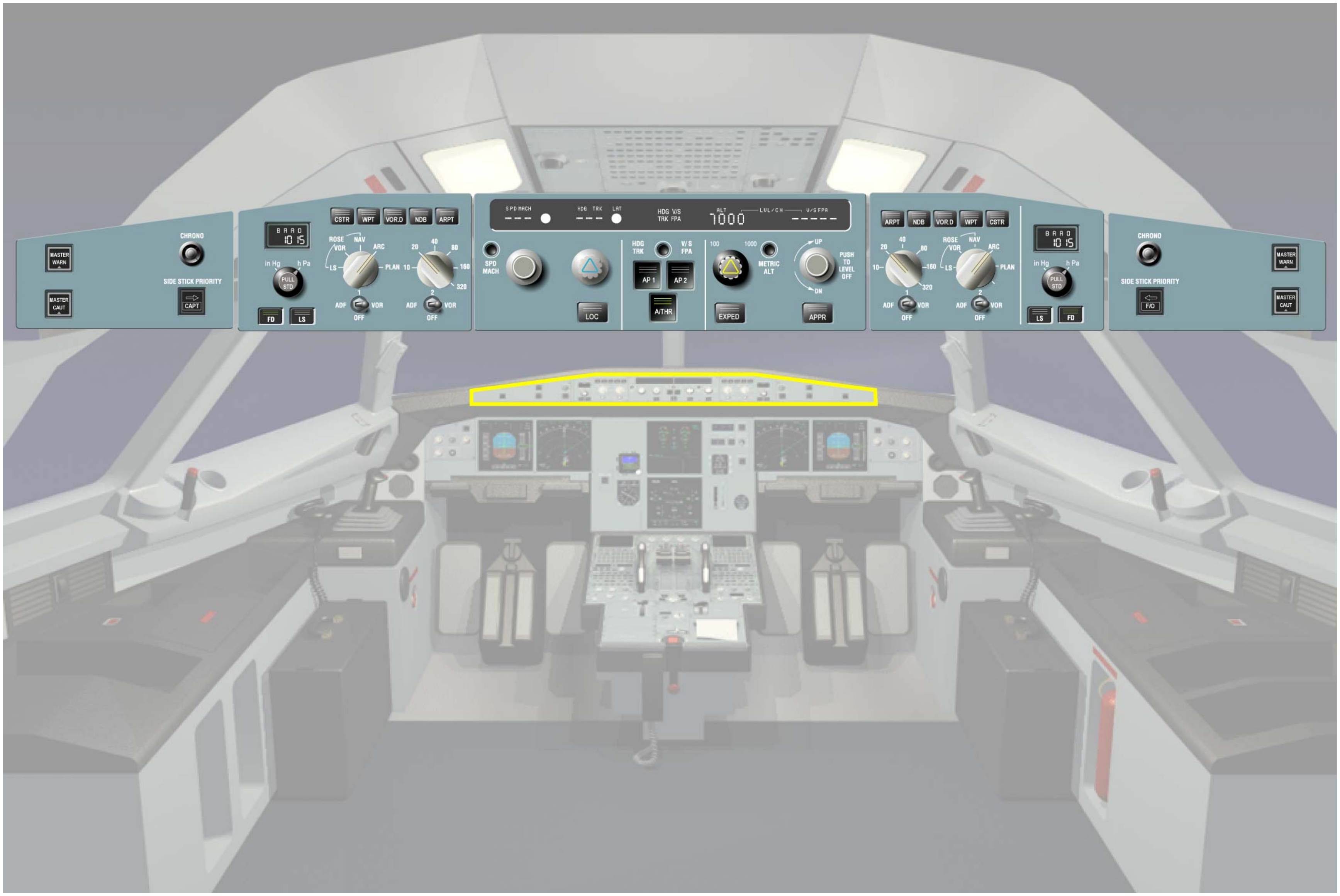
U7Z08431 - U0OT4T0 - UM00PY000000001

00 SA FAMILY PRESENTATION (1)

COCKPIT PRESENTATION (continued)

GLARESHIELD

The Flight Control Unit (FCU) includes the EFIS controls, and is used for control and monitoring of the Auto Flight System (AFS). It is located on the glareshield.
The "Master Warning" and the "Master Caution" lights are also located on the glareshield.



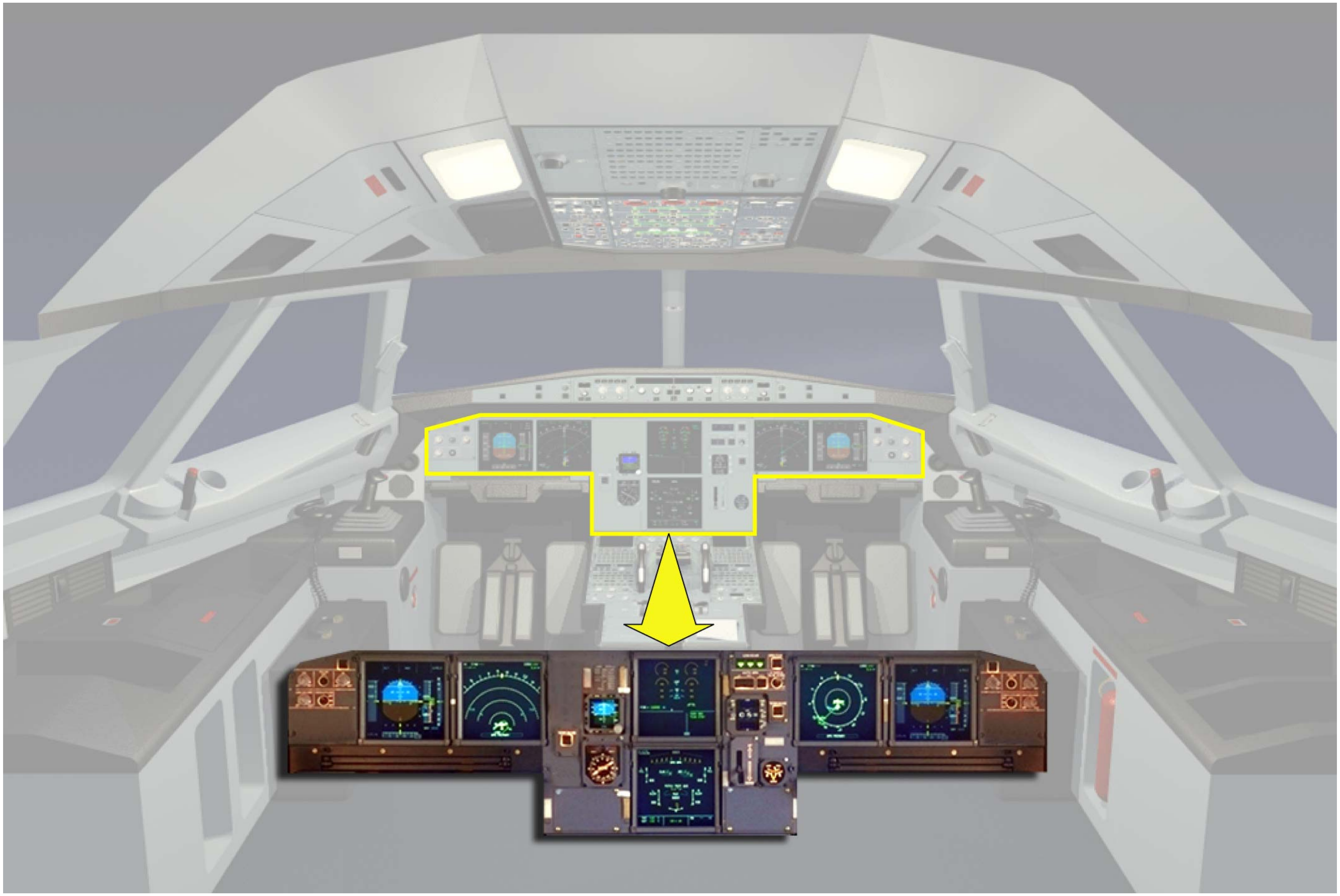
COCKPIT PRESENTATION - GLARESHIELD

00 SA FAMILY PRESENTATION (1)

COCKPIT PRESENTATION (continued)

MAIN INSTRUMENT PANEL (ENHANCED)

The enhanced single aisle aircraft main instrument panel instrumentation has been updated. Liquid Crystal Displays (LCDs) replace the existing CRTs. A single integrated electronic indicator, the Integrated Standby Instrument System (ISIS) replaces the standby instrumentation: Standby horizon, Airspeed indicator and Altimeter.



COCKPIT PRESENTATION - MAIN INSTRUMENT PANEL (ENHANCED)

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00 SA FAMILY PRESENTATION (1)

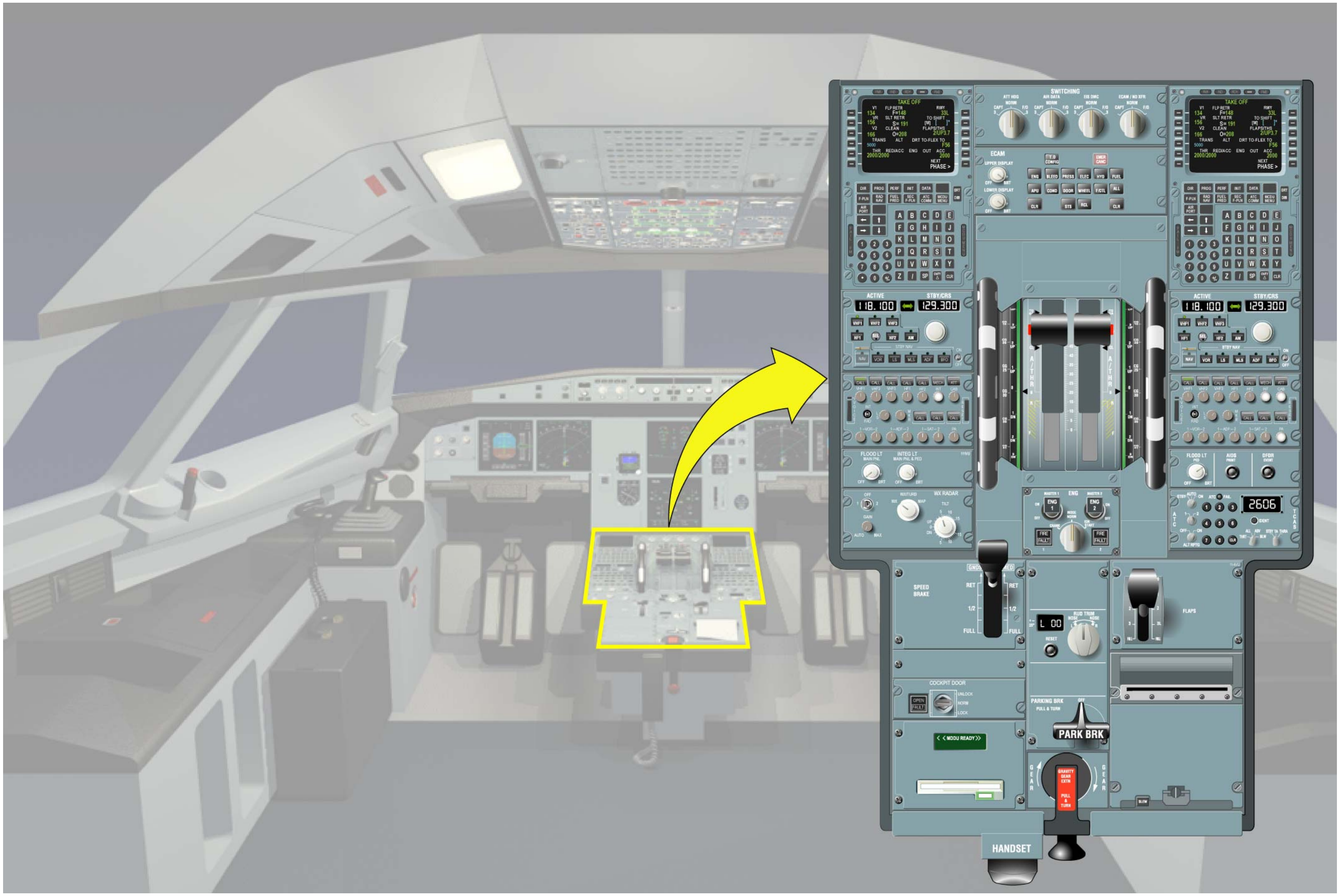
COCKPIT PRESENTATION (continued)

CENTER PEDESTAL

The center pedestal ergonomic design of the SA family aircraft gives the flight crew efficient access to multiple system controls without compromising safety.

The panels are:

- Switching panel
- ECAM control panel (ECP)
- Multipurpose Control Display Units (MCDU)
- Radio Management Panels (RMPs)
- Audio Control Panels (ACPs)
- Thrust levers and thrust reverser levers
- Pitch trim wheel
- Engine start panel
- Air Traffic Control / Traffic Collision Avoidance System panel (ATC/TCAS)
- Flap/slat control handle
- Speed brake control panel
- Parking brake control panel
- Cockpit door lock panel
- Landing gear gravity extension handle
- Printer
- Multifunction disk drive unit
- Pa handset at the rear of the pedestal



COCKPIT PRESENTATION - CENTER PEDESTAL

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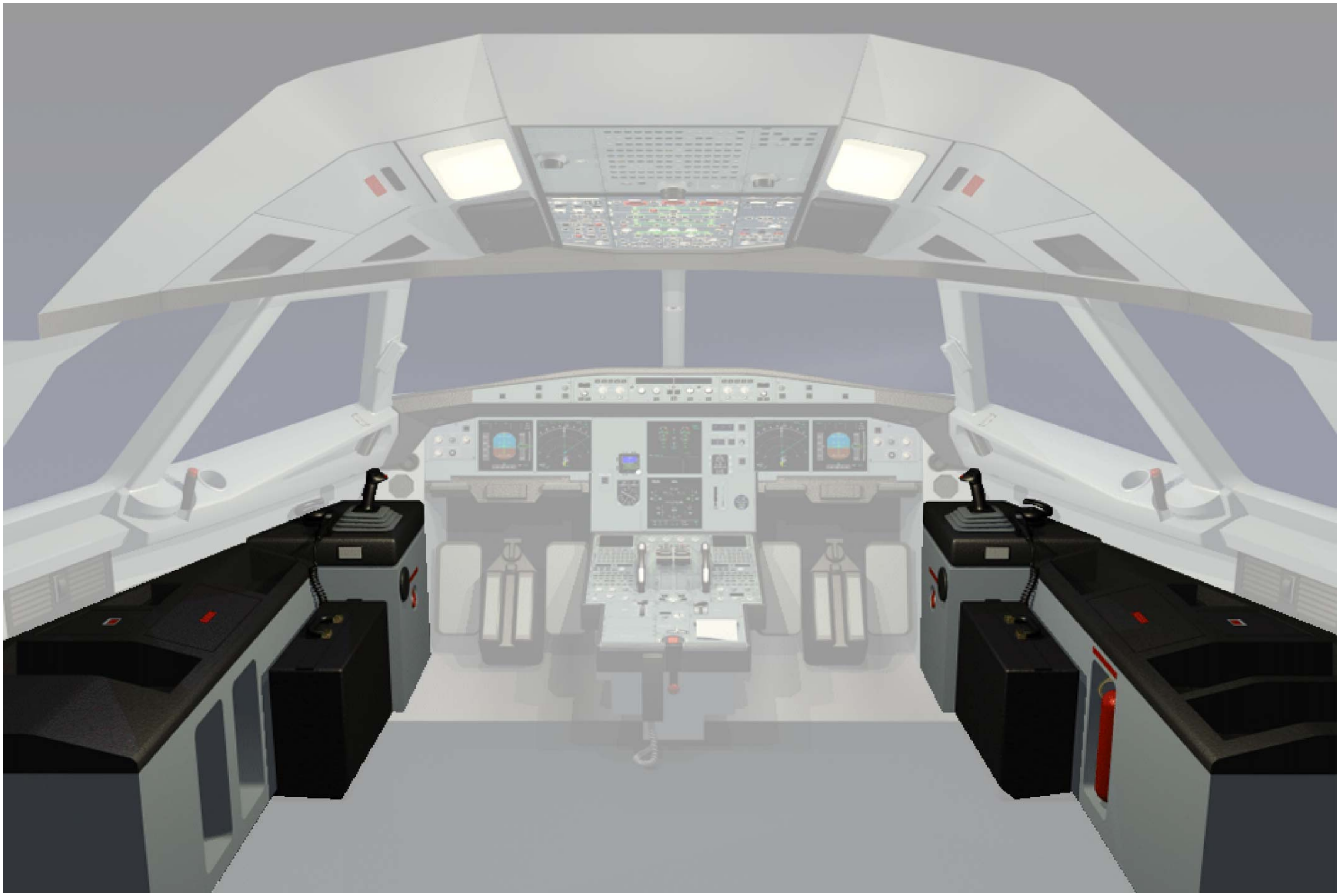
00 SA FAMILY PRESENTATION (1)

COCKPIT PRESENTATION (continued)

SIDE CONSOLES

The Conventional Aircraft control yoke is noticeably missing in the Airbus Single Aisle aircraft. The Side Stick Controller (SSC) replaces the Conventional Aircraft yoke. There is one SSC for each pilot mounted in the side consoles.
The Aircraft nose wheel is steerable. The flight crew operates the Nose Wheel Steering (NWS) by using the NWS tillers mounted outboard of the SSC on the same side console.
Behind the most forward side console are installed several other compartments along the outboard sides of the cockpit. These side consoles are used as stowage space for documents, oxygen masks, fire extinguisher and microphone and headset connections



COCKPIT PRESENTATION - SIDE CONSOLES

00 SA FAMILY PRESENTATION (1)

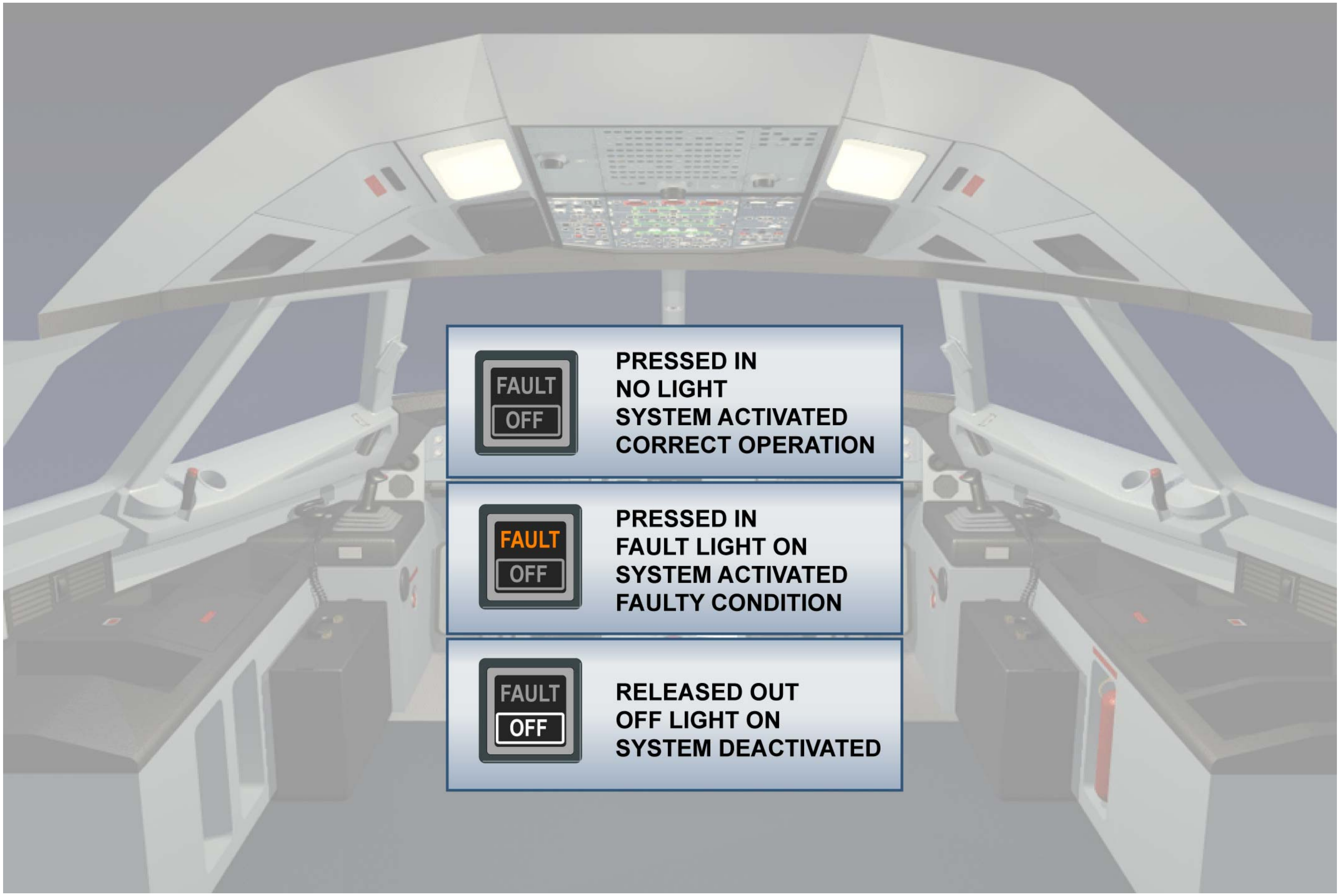
COCKPIT PHILOSOPHY

Prior to the design of the A320 family aircraft, the designers examined previous generation aircraft cockpit system indications. A decision was made on the system indicator lights on the overhead panel that indicator lights do not come on when systems are in normal operation and there are no failures.
This ergonomic design enabled the pilots to immediately see when a system is faulty or has been manually shut off.
Most of the pushbuttons with light have two stable positions: pressed in and released out, each position is related to a control signal sent to a system.
Pressed in (recessed):
- normally used system activation (AUTO or ON),
- temporarily used system activation (ON),
- system activated for maintenance operation (ON) or override (OVRD).

Released out (flush with the panel):
- deactivation system (OFF),
- manual activation of a system (ON),
- activation of an alternate system (ALTN).

Some pushbuttons have only one stable position:
- released out.

When pushed, they send a control signal to the system.



COCKPIT PHILOSOPHY

U7Z08431 - U0OT4T0 - UM00PY000000001

00 SA FAMILY PRESENTATION (1)

COCKPIT PHILOSOPHY (continued)

PUSHBUTTON COLOR PHILOSOPHY

The pushbuttons light and annunciator lights are in different colors according to their function.
In normal operation, only green lights and, sometimes, blue lights come on.

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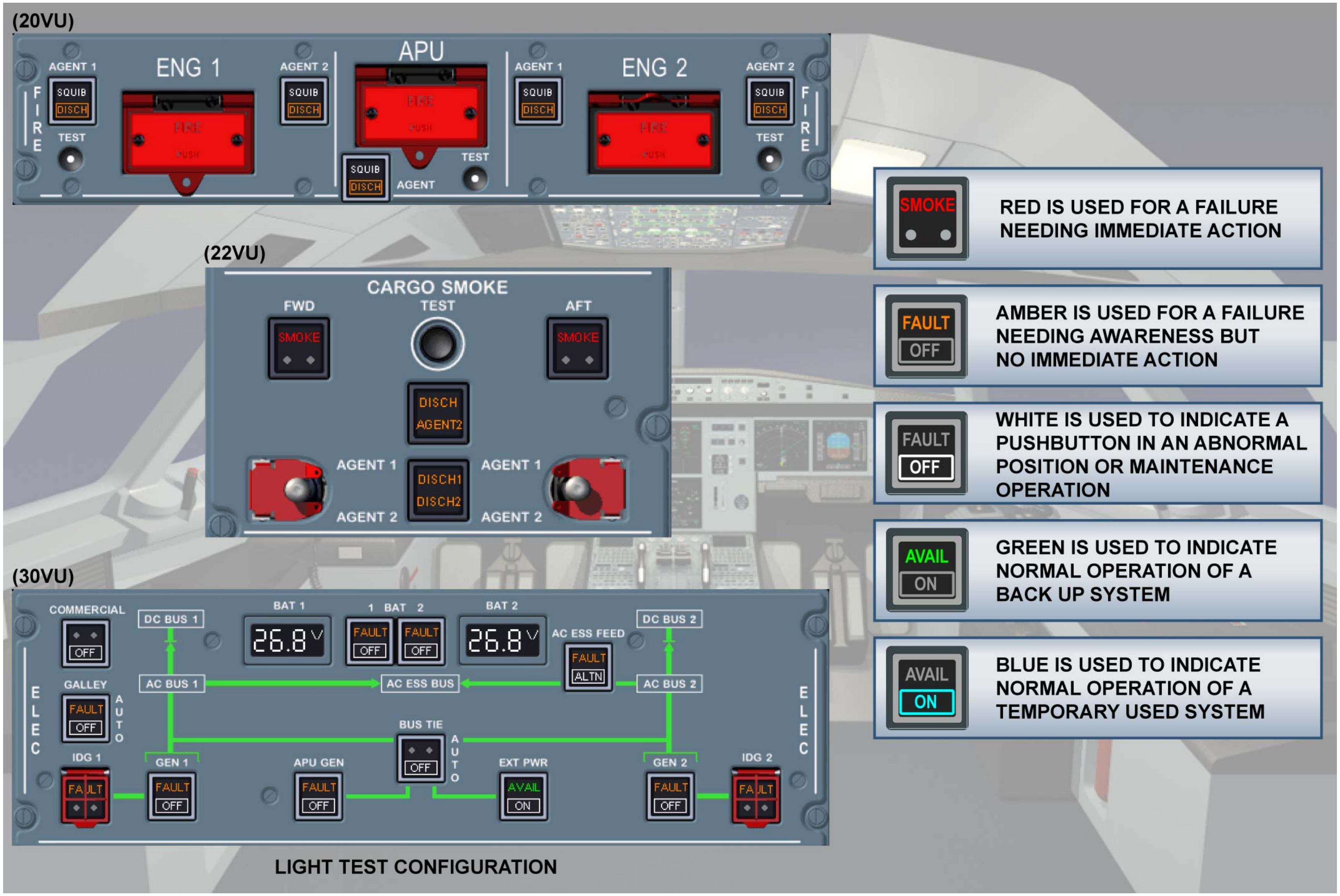


COCKPIT PHILOSOPHY - PUSHBUTTON COLOR PHILOSOPHY

U7Z08431 - U0OT4T0 - UM00PY000000001

00 SA FAMILY PRESENTATION (1)

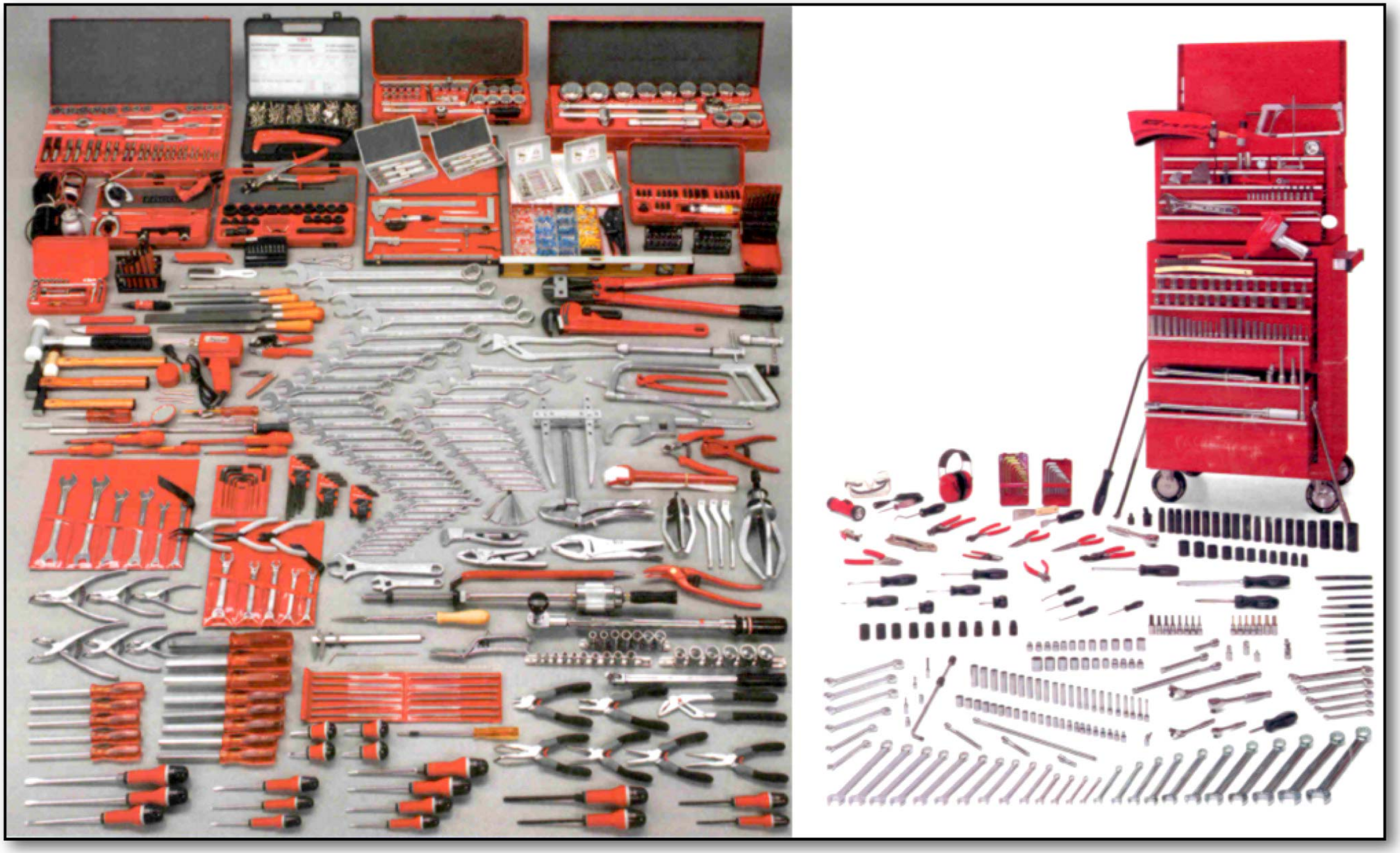
GROUND SUPPORT EQUIPMENT AND TOOLS

The World Airlines Technical Operations Glossary (WATOG) definition of Ground Support Equipment (GSE) is:
equipment required on the ground to support the operation and maintenance of the aircraft and all its airborne equipment.
Airbus divides GSE into two categories:
- tools,
- standard GSE.

Tools can be split into two categories:
- standard tools,
- specific tools.

STANDARD TOOLS

Standard tools are hand tools such as spanners, sockets, gauges, torque wrenches...
The specifications (size, range, capacity, accuracy...) are given in the related Aircraft Maintenance Manual (AMM) task to let operators use the tool brand of their choice.
Standard tools for Aircraft Maintenance are all in US units.
Metric tools maybe required for shop maintenance.
They are not required for aircraft maintenance but will be required to maintain Airbus specific tools and, in some cases, for aircraft component maintenance in the shop.



GROUND SUPPORT EQUIPMENT AND TOOLS - STANDARD TOOLS

U7Z08431 - U0OT4T0 - UM00PY000000001

00 SA FAMILY PRESENTATION (1)

GROUND SUPPORT EQUIPMENT AND TOOLS (continued)

SPECIFIC TOOLS

Specific tools are tools designed by Airbus or by its vendors to carry out given maintenance tasks on the aircraft or one of its components.
All maintenance tools for "on - aircraft" maintenance such as the AMM, Trouble Shooting Manual (TSM)... and for "off - aircraft" maintenance such as the Component Maintenance Manual (CMM) are found in the Support Equipment Summary (SES) document.
The SES covers all Airbus aircraft types and all associated documentation.
If a tool does not appear in the SES it is not a tool for Airbus aircraft or equipment.
All specific tools called up for "on - aircraft" maintenance in the AMM and the TSM are illustrated in the Tool Equipment Manual (TEM).

GROUND SUPPORT EQUIPMENT AND TOOLS - SPECIFIC TOOLS

00 SA FAMILY PRESENTATION (1)

GROUND SUPPORT EQUIPMENT AND TOOLS (continued)

STANDARD GSE

Airbus considers as standard GSE any GSE which is not designed for a specific aircraft type, but it can/could be used on a number of different aircraft types.
Standard GSE includes, but is not limited: tow bars, axle/wheel change jacks, tripod maintenance jacks, access platforms, hydraulic ground carts, electrical power units, etc...

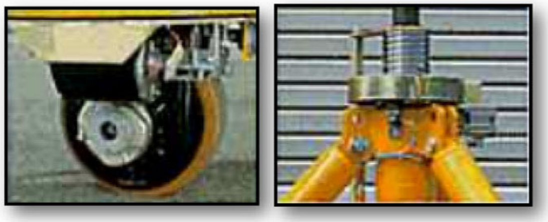
MAIN LANDING GEAR FLAT TYRES AXLE JACK

HYDRAULIC AXLE JACK

TRIPOD JACKS

TROLLEY JACK UP TO 77 TONNES

SET OF FLYAWAY AXLE JACKS



TOW BAR AXLE

GROUND SUPPORT EQUIPMENT AND TOOLS - STANDARD GSE

00 SA FAMILY PRESENTATION (1)

JACKING

Three jacking points, when equipped with jacking pads, are used to lift the aircraft. The forward point "A" is located forward of the nose landing gear. The points "B" and "C" are located outboard of the engine pylon.
A safety jack positioned at the rear of the aircraft prevents the aircraft from tipping up.
The open air jacking operation is limited if the wind velocity exceeds permissible values which depend on aircraft gross weight and center of gravity position.
In any condition, the aircraft must be pointed upwind.
The three jacks have to be operated together.
The aircraft has to be lifted so that the landing gear can be operated in the "landing gear shock absorbers deflated, flat tyres" configuration.
As soon as the jacking operation is finished, position the safety jack at the tail.
Jacking pads have to be used under the jacking points to spread the loads.
To make sure that excessive side loads are not placed on the jacks and on the aircraft structure, a quick leveling check must be carried out during the jacking operation.
The aircraft attitude monitor is located in the refuel/defuel control panel recess.
The "D4" position corresponds to a longitudinal angle of 0 degree and a lateral angle of 0 degree.

JACKING

00 SA FAMILY PRESENTATION (1)

TOWING

Towing: you can tow the aircraft by the nose landing gear or the main landing gear. You can also tow the aircraft with deflated tires.
Towing operation, whether push back or pull, requires a good team co-operation.
Some airlines have two different types of towing procedures in use:
- maintenance towing,
- transportation servicing towing.

Maintenance towing procedures are laid down in the applicable AMM - Chapter 09.
Transportation servicing towing procedures are published in the applicable ramp operation manuals.
The major differences between the two are that transportation services only get involved with moving aircraft on ramps for positioning or dispatch pushback.
When they are handling the towing operation, they require either a pilot or qualified maintenance man on the aircraft brakes.
On the other hand, maintenance personnel is involved in moving aircraft in abnormal situation such as aircraft stuck in mud, towing with flat tires, engines removal, etc., as well as routine towing to gates.
Because of the hazards that may be involved in the towing operation, major precautions taken have been gathered together and are listed under paragraph "General Towing Precaution".
Caution and warnings are repeated as necessary in the particular step of the towing operation to which they apply.

TOWING

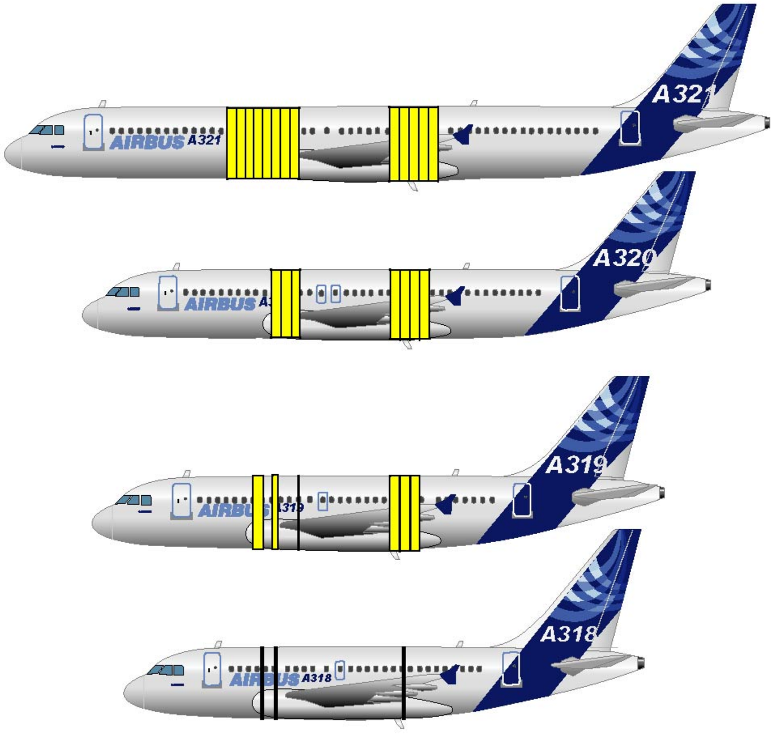
00 SA FAMILY PRESENTATION (1)

SAFETY ITEMS

When you work on aircraft, make sure that you obey all the AMM safety procedures. This will prevent injury to persons and/or damage to the aircraft
The following terms are used in the AMM and are defined as follows:

WARNING: call attention to the use of material, processes, methods, procedures or limits, which must be followed precisely to avoid injury or death to persons.

CAUTION: call attention to methods and procedures, which must be followed to avoid damage to equipment.



SAFETY ITEMS

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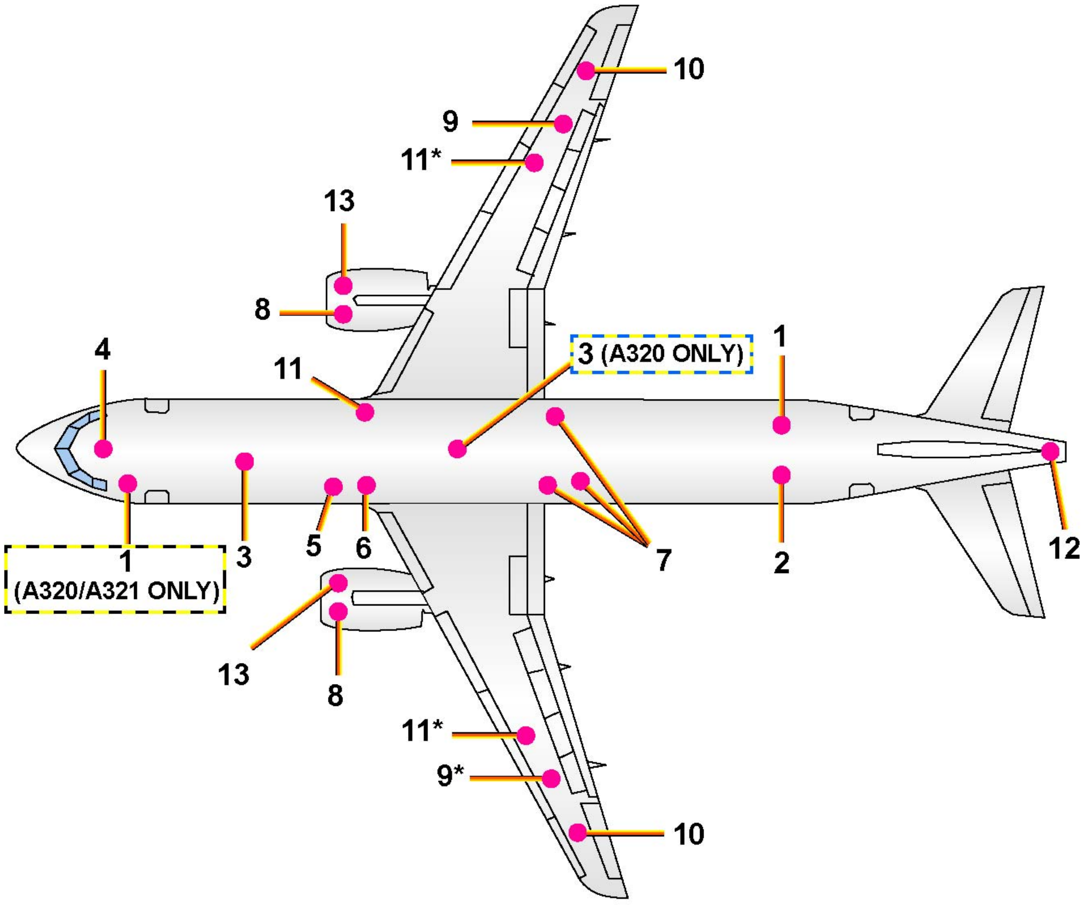
00 GROUND HANDLING (1)

SERVICING POINTS

The ground service connections layout is the same on the AIRBUS A318 and A319.The main difference between A320 and A321 servicing point is a second potable water draining panel in the center of the A/C on the A320.

U7Z08431 - U0OT4T0 - UM01P2000000001



1:	LAVATORY SERVICE DOOR	7:	HYDRAULIC SYSTEM GROUND SERVICE PANEL
2:	POTABLE WATER SERVICE PANEL	8:	ENGINE OIL FILLING CONNECTOR
3:	WATER DRAIN PANEL	9:	REFUEL/DEFUEL COUPLING
4:	EXTERNAL POWER RECEPTACLE	10:	GRAVITY FILLING PANEL
5:	GROUND SERVICE CONDITIONED AIR CONNECTION	11:	REFUEL/DEFUEL CONTROL PANEL
6:	HP AIR GROUND CONNECTOR:	12:	APU OIL FILLING CONNECTOR
	- GRAVITY FILLING PANEL	13:	IDG OIL FILLING CONNECTOR
	- PRESSURE FILLING CONNECTION	* :	OPTION

HP: High Pressure
IDG: Integrated Drive Generator

SERVICING POINTS

U7Z08431 - U0OT4T0 - UM01P2000000001

00 GROUND HANDLING (1)

A/C SERVICING ARRANGEMENT

The graphic shows the access to the aircraft by various servicing equipment. The A318 fuselage is shorter than the rest of the single aisle aircraft. Due to the removal of 2.39 meters or 1.5 frames of the forward fuselage, the aft edge of the forward cargo compartment door now is in close proximity to the engine air intake nose cowl. When using a self propelled conveyor belt, there is a possibility of structural damage to the nose cowl because of the clearance.

NOTE: Note: The use of a self-propelled conveyor belt is not recommended by Airbus.

The main difference between the A318/A319 and the A320/A321 servicing arrangement is that the A320 and A321 can have a bulk loader on the bulk cargo door.

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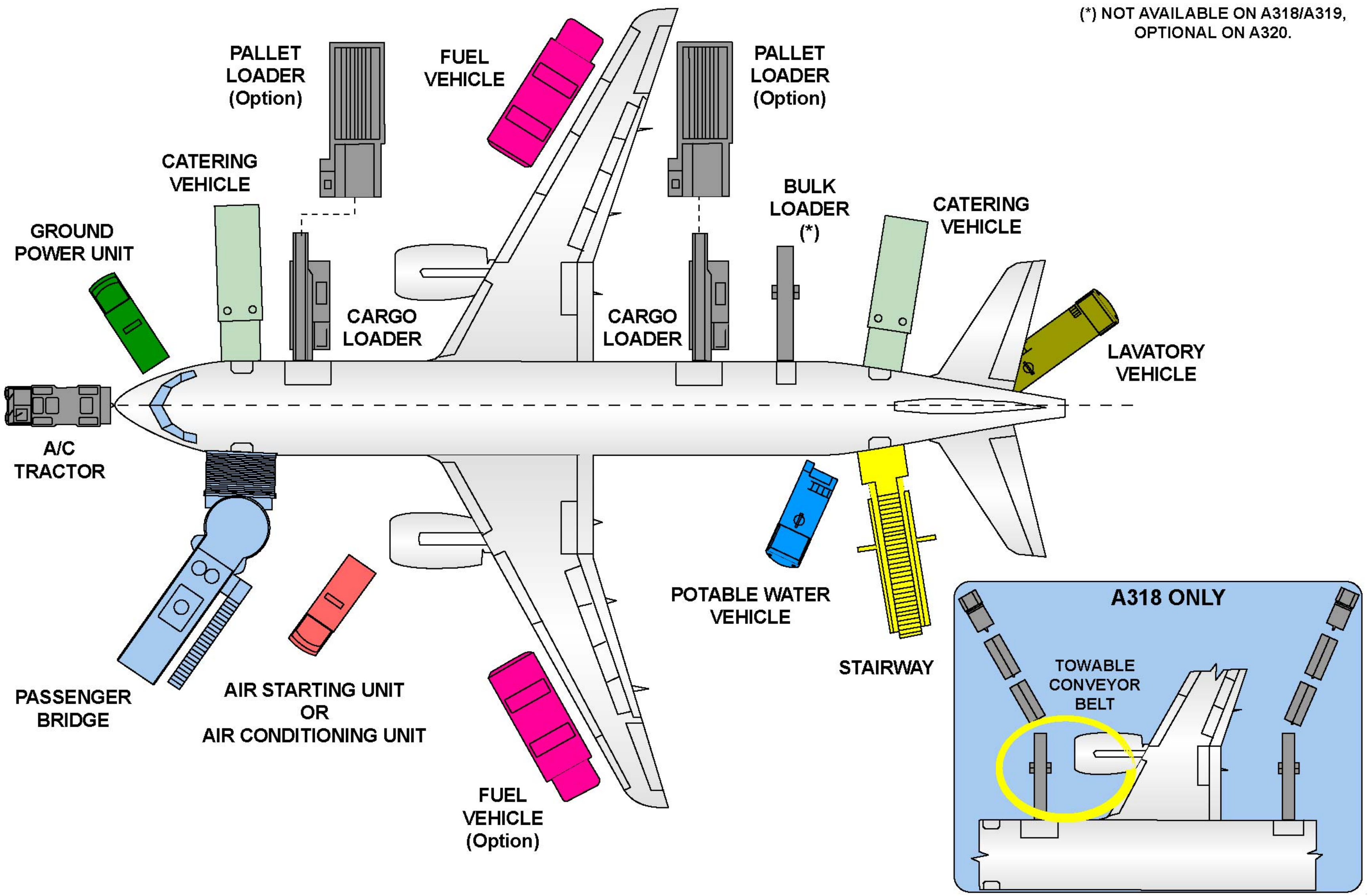

A/C SERVICING ARRANGEMENT

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00 GROUND HANDLING (1)

TURNING RADII

The different turning radii are shown on a steering diagram. "Y" is the distance between the centerline of the A/C longitudinal axis (X-axis) and the theoretical center of turn for turning radius. "A" matches the minimum turning width for a 180° turn. "Y, A" and the radii "R3, R4, R5 and R6" values depend on two parameters: effective turn angle and steering angle.

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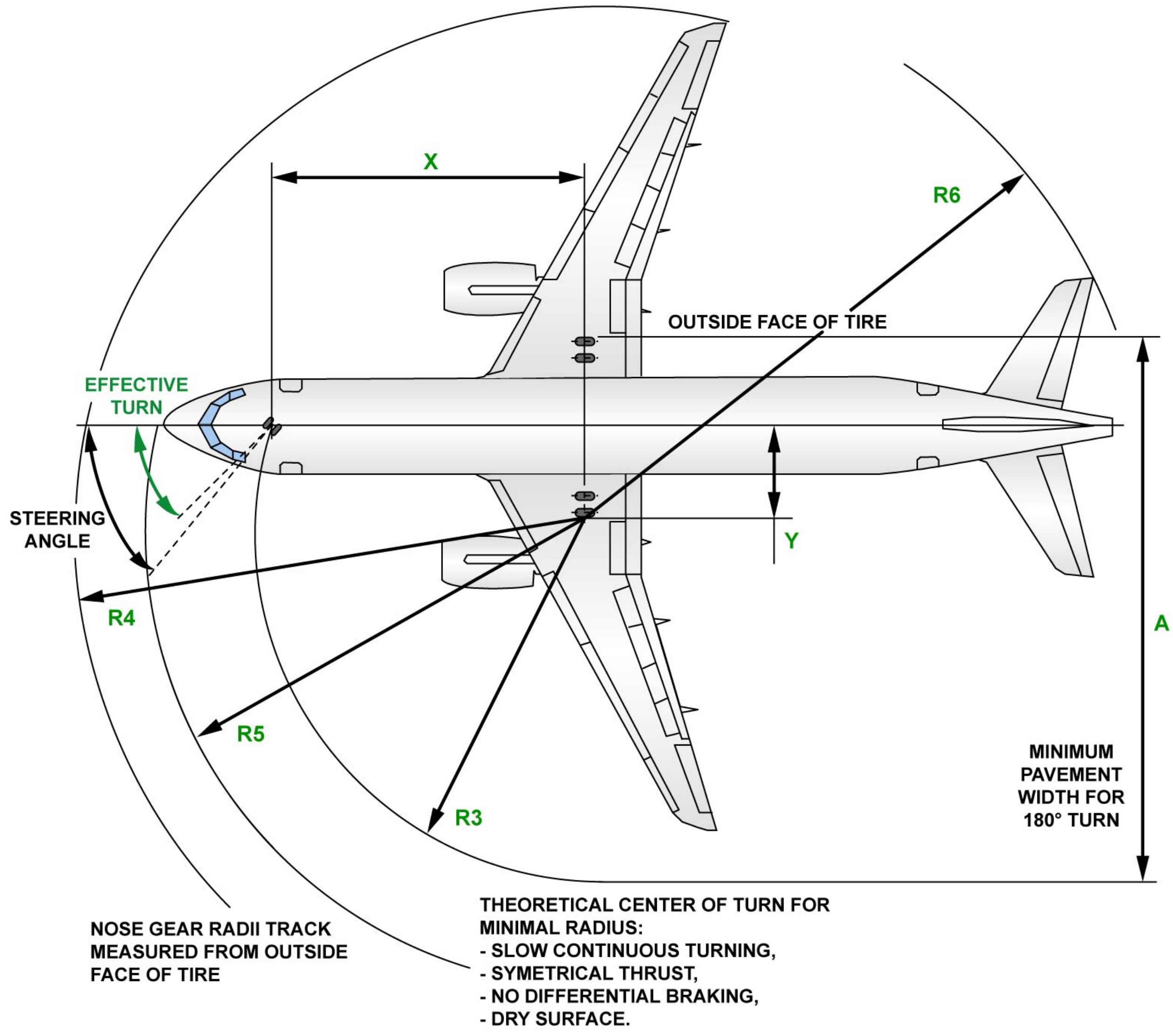


AT 75° STEERING ANGLE:

	A318	A319	A320	A321
EFFEC TURN	73.20°	70.03°	70°	73°
X	33'8" 10.25	36'3" 11.04	41'6" 12.64	55'5" 16.91
Y	10'1" 3.1	13'2" 4.01	15'1" 4.6	16'7" 5.1
A	61'2" 18.7	67'8" 20.64	75'1" 22.9	90'6" 27.6
R3	36'4" 11.1	39'8" 12.11	45'4" 13.81	59'1" 18
R4	67'7" 20.6	70'10" 21.58	72'2" 21.99	74'4" 22.7
R5	51'4" 15.6	54'6" 16.6	60' 18.3	74' 22.6
R6	58'10" 17.9	64'11" 19.77	71'11" 21.91	80'4" 24.5

FEET / INCHES
METERS

TURNING RADII

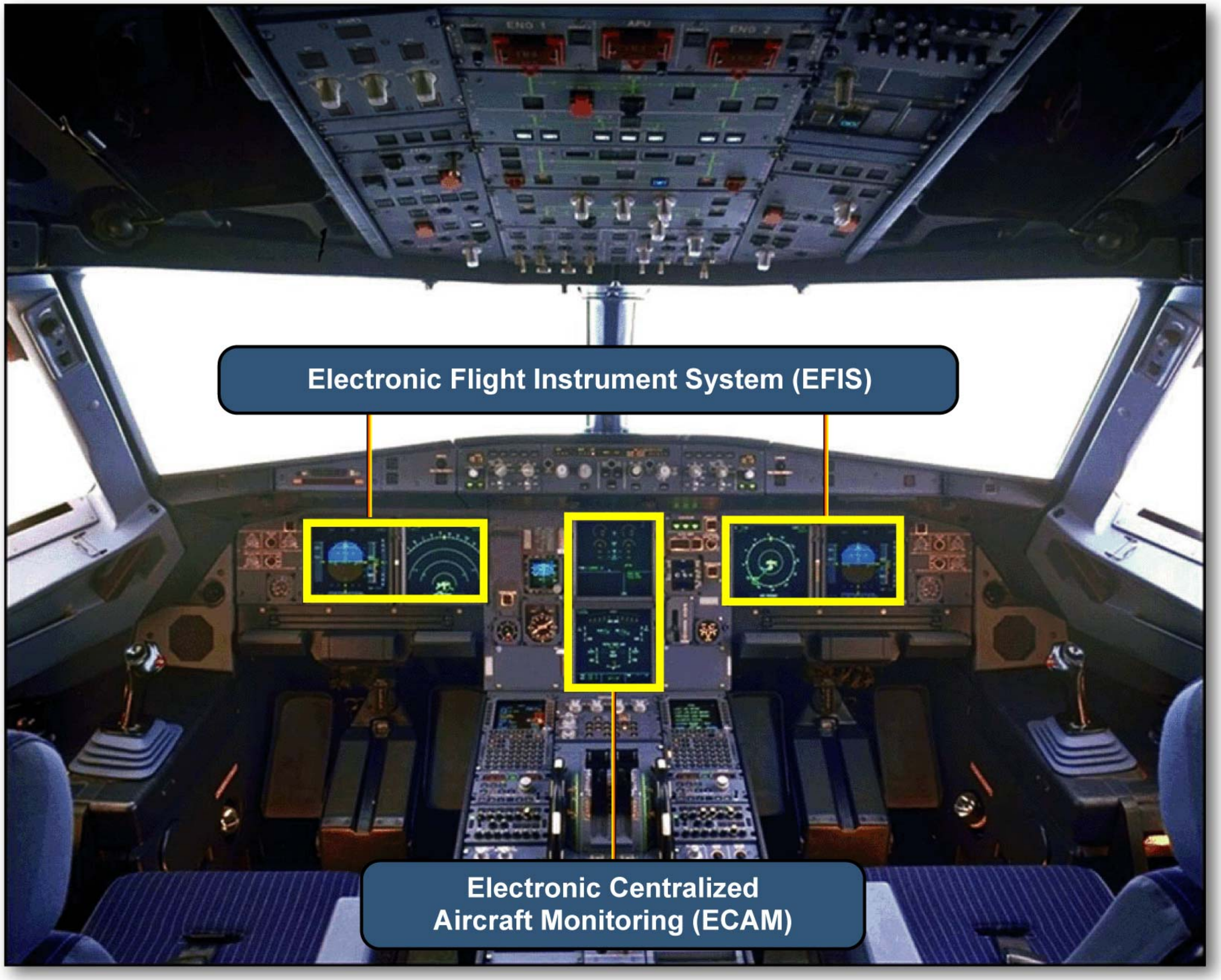
U7Z08431 - U0OT4T0 - UM01P2000000001

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ELECTRONIC INSTRUMENT SYSTEM

The Single Aisle aircraft cockpit instrumentation information is displayed on six display units. These display units are part of the Electronic Instrument System (EIS).
The EIS is separated into two subsystems:
- Electronic Flight Instrument System (EFIS),
- Electronic Centralized Aircraft Monitoring (ECAM).

The four EFIS displays (2 for each flight crew member) give to the flight crew all the basic flight parameters. The ECAM system gives to the flight crew aircraft system displays, faults, checklists and the aircraft operational status.



ELECTRONIC INSTRUMENT SYSTEM

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31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ELECTRONIC INSTRUMENT SYSTEM (continued)

ECAM

The System Data Acquisition Concentrators (SDACs) receive data from the A/C systems and sends it to the Display Management Computers (DMCs) for display on the ECAM display units.

NOTE: Note: DMC 1 supplies both ECAM displays and DMC 2 is also a backup for ECAM displays.

The DMCs acquire data and transmit it to the Display Units (DUs), which generate the images. Under normal circumstances:
- DMC 1 supplies both ECAM display,
- DMC 2 and 3 are available as a backup.

The Flight Warning Computers (FWCs), heart of the ECAM system, receive data from:
- the A/C systems to generate red warnings,
- the SDACs to generate amber cautions.

The FWCs then supply:
- the DMCs for the display of alert messages,
- the attention getters,
- the loudspeakers with aural alerts and synthetic voice messages.

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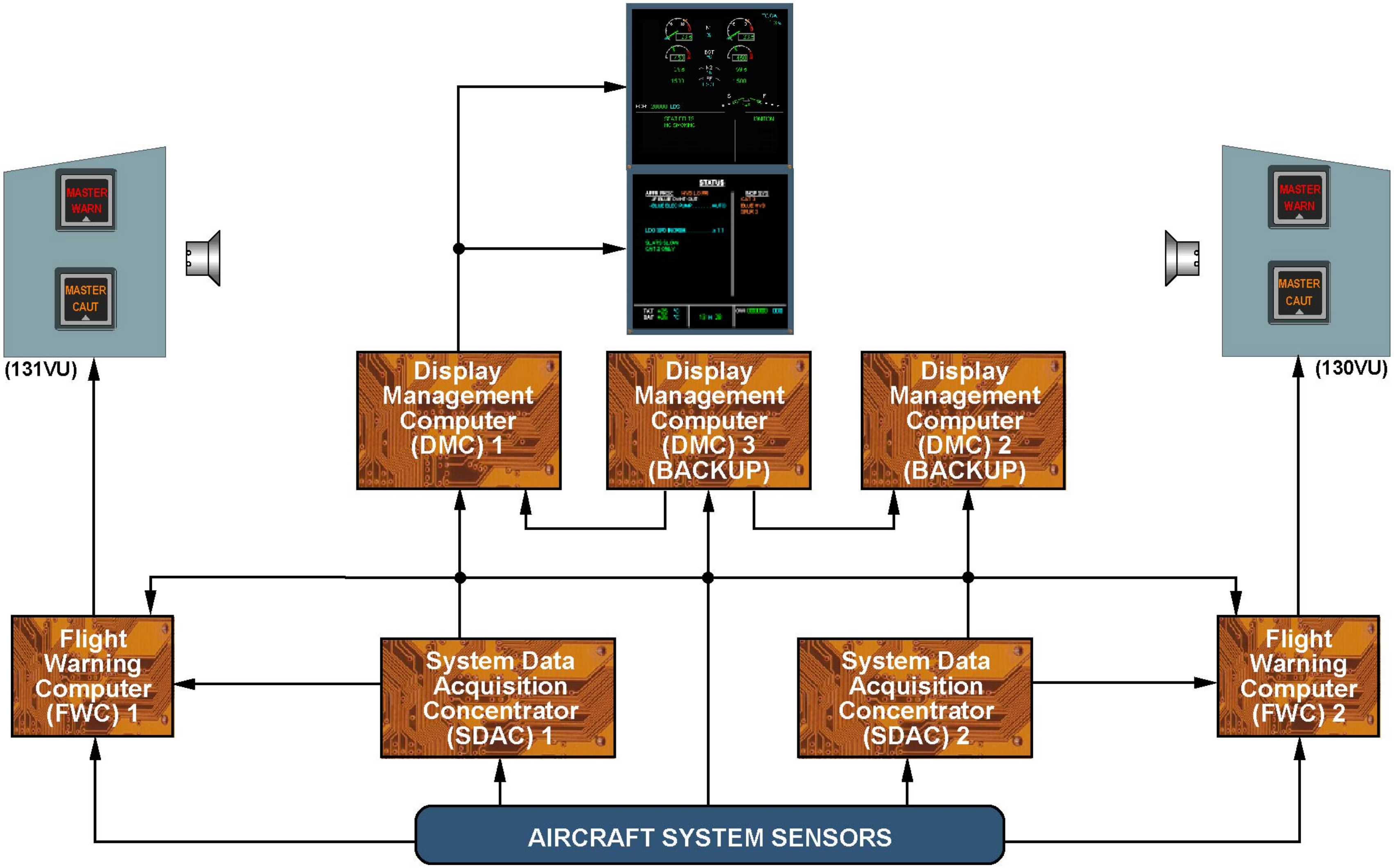


ELECTRONIC INSTRUMENT SYSTEM - ECAM

U7Z08431 - U0OT4T0 - UM31PZ000000002

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ELECTRONIC INSTRUMENT SYSTEM (continued)

ECAM CONTROL AND INDICATING

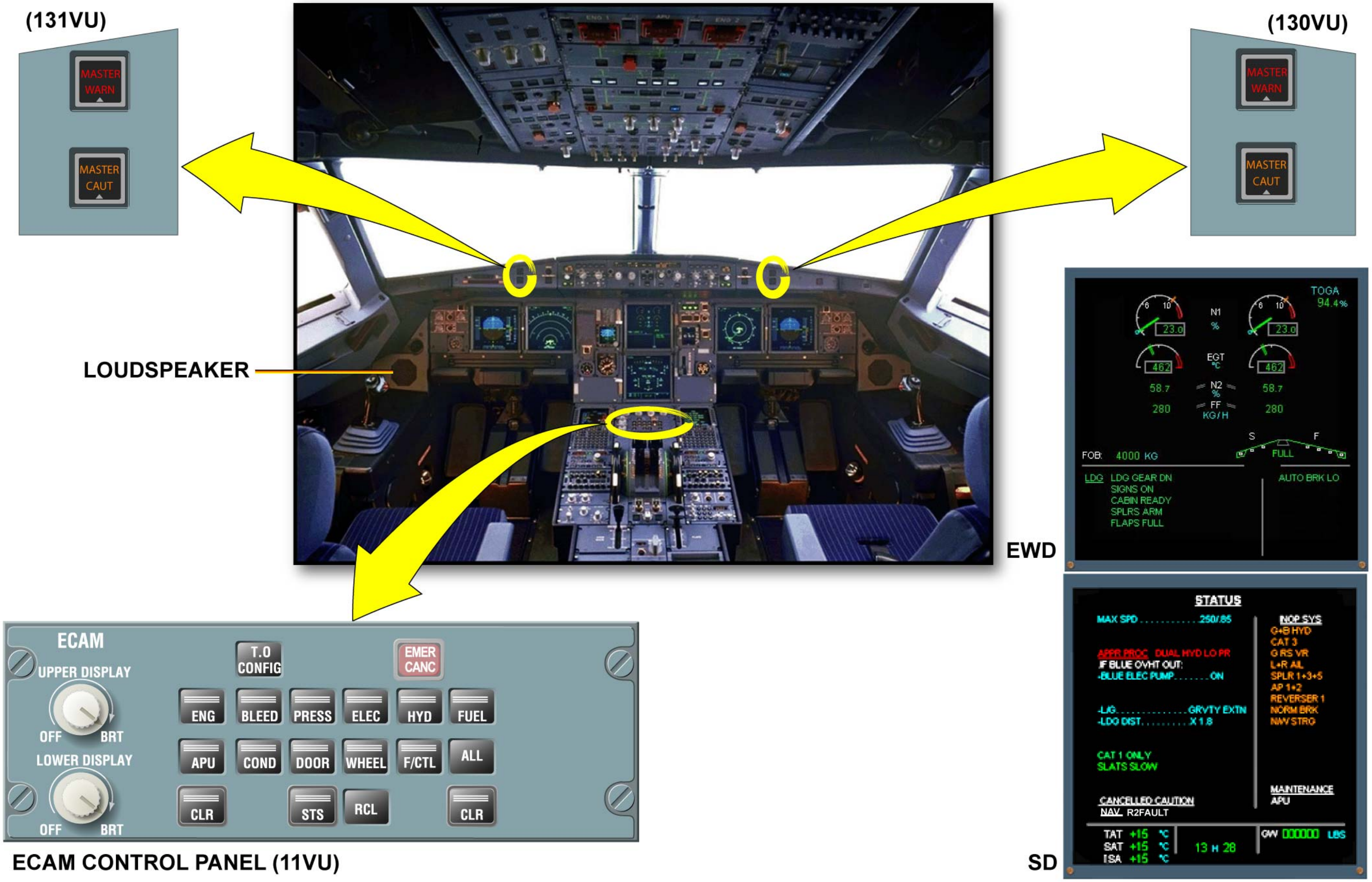
The EWD is divided into two main parts:
- the upper area is used to display the main engine parameters, the Fuel On Board (FOB) and the slat/flap position,
- the lower area is used for warning, caution and memo messages.

The SD is divided into two areas:
- the upper part is used to display the various system pages, diagrams of the A/C systems,
- the lower part is used to display permanent data.

Below the ECAM displays, on the center pedestal, there is the ECAM control panel. The two control knobs on the LH side are used to adjust the brightness of the two ECAM screens and to turn them off. The P/Bs on the RH side are mainly used to:
- display any of the system pages or the STATUS page,
- clear or recall a warning or caution message.

An A/C STATUS page may be also displayed on the SD to give an operational status of the A/C. When things are not normal the STATUS page displays:
- operational data on the LH side,
- INOPerative SYStem on the RH side.

In front of each pilot, there are two attention getters, a red MASTER WARNing and an amber MASTER CAUTion. As a further means of getting the attention, there is a loudspeaker on each side of the cockpit for aural alerts and synthetic voice messages.



ELECTRONIC INSTRUMENT SYSTEM - ECAM CONTROL AND INDICATING

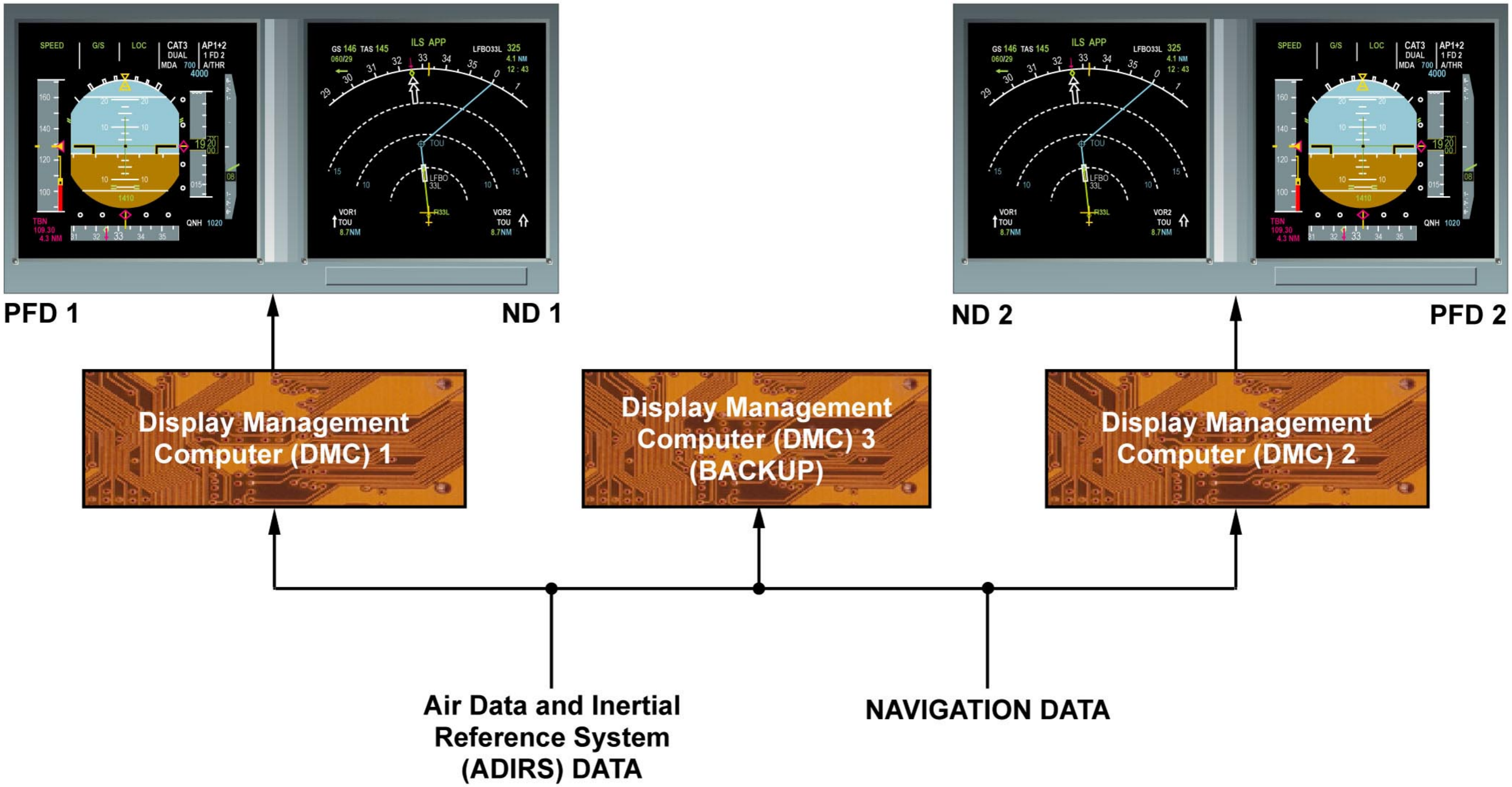
U7Z08431 - U0OT4T0 - UM31PZ000000002

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ELECTRONIC INSTRUMENT SYSTEM (continued)

EFIS

For the EFIS displays, data from the Air Data and Inertial Reference System (ADIRS) plus navigation data from the Flight Management and Guidance System (FMGS) is fed directly to the DMCs.
The DMCs then process the data and generate the images to display.
Under normal circumstances:
- DMC 1 supplies the CAPT EFIS displays,
- DMC 2 supplies the F/O EFIS displays,
- DMC 3 is available as a backup.



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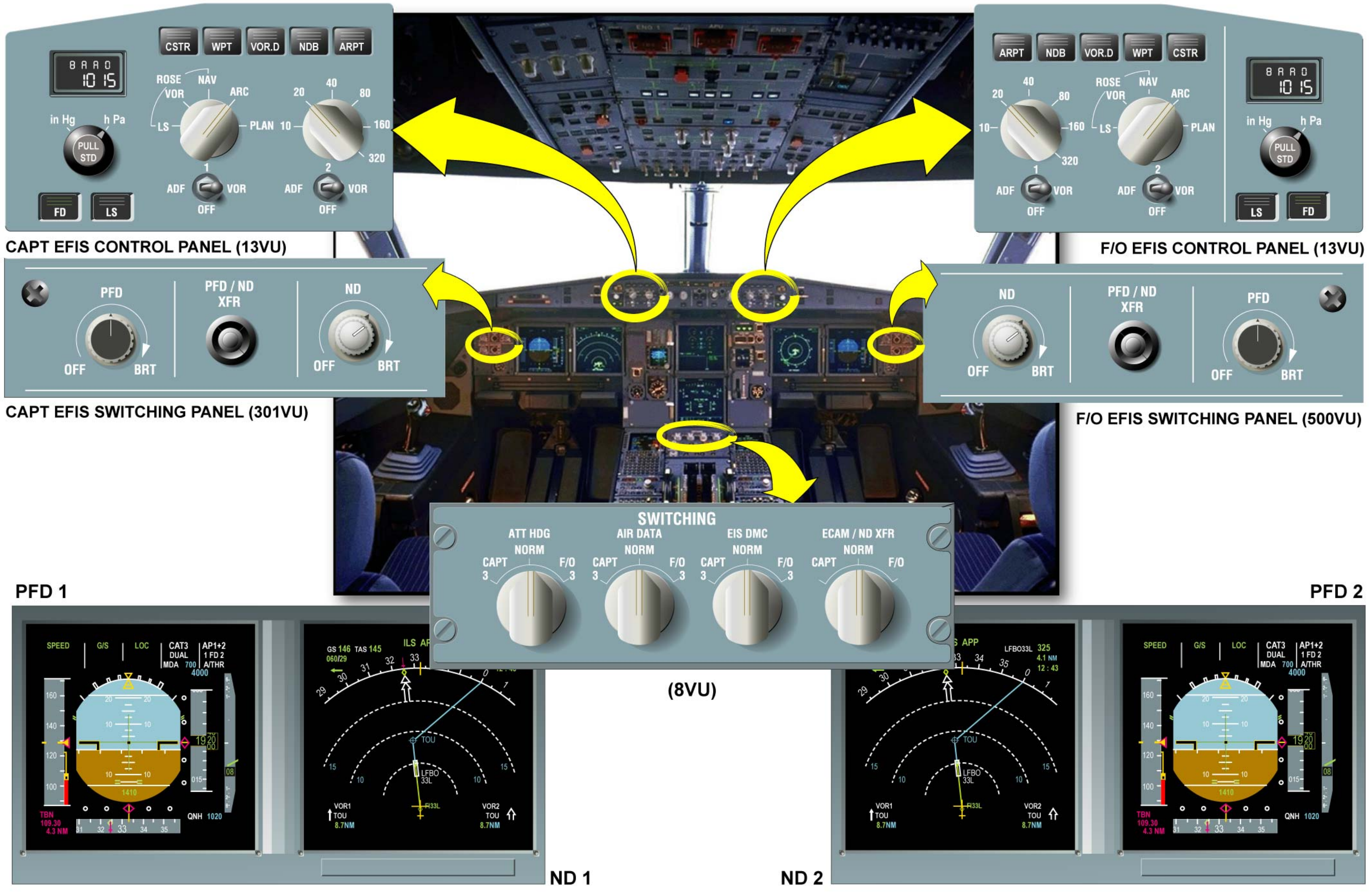
ELECTRONIC INSTRUMENT SYSTEM - EFIS

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ELECTRONIC INSTRUMENT SYSTEM (continued)

EFIS CONTROL AND INDICATING

Flight parameters are displayed on the PFDs while navigation data is displayed on the NDs.
Outboard of the PFDs, there are control knobs to adjust the brightness of the associated PFD and ND, and to turn the displays off.
Two EFIS control panels are used to select what is displayed on the EFIS screens. The EFIS control panels are divided into two sections, one section associated with the PFD and the other one with the ND.
Just below the ECAM screens, on the center pedestal, there is a switching panel with, on the right, 2 rotary selectors to restore data to the EFIS and ECAM displays in abnormal operation.

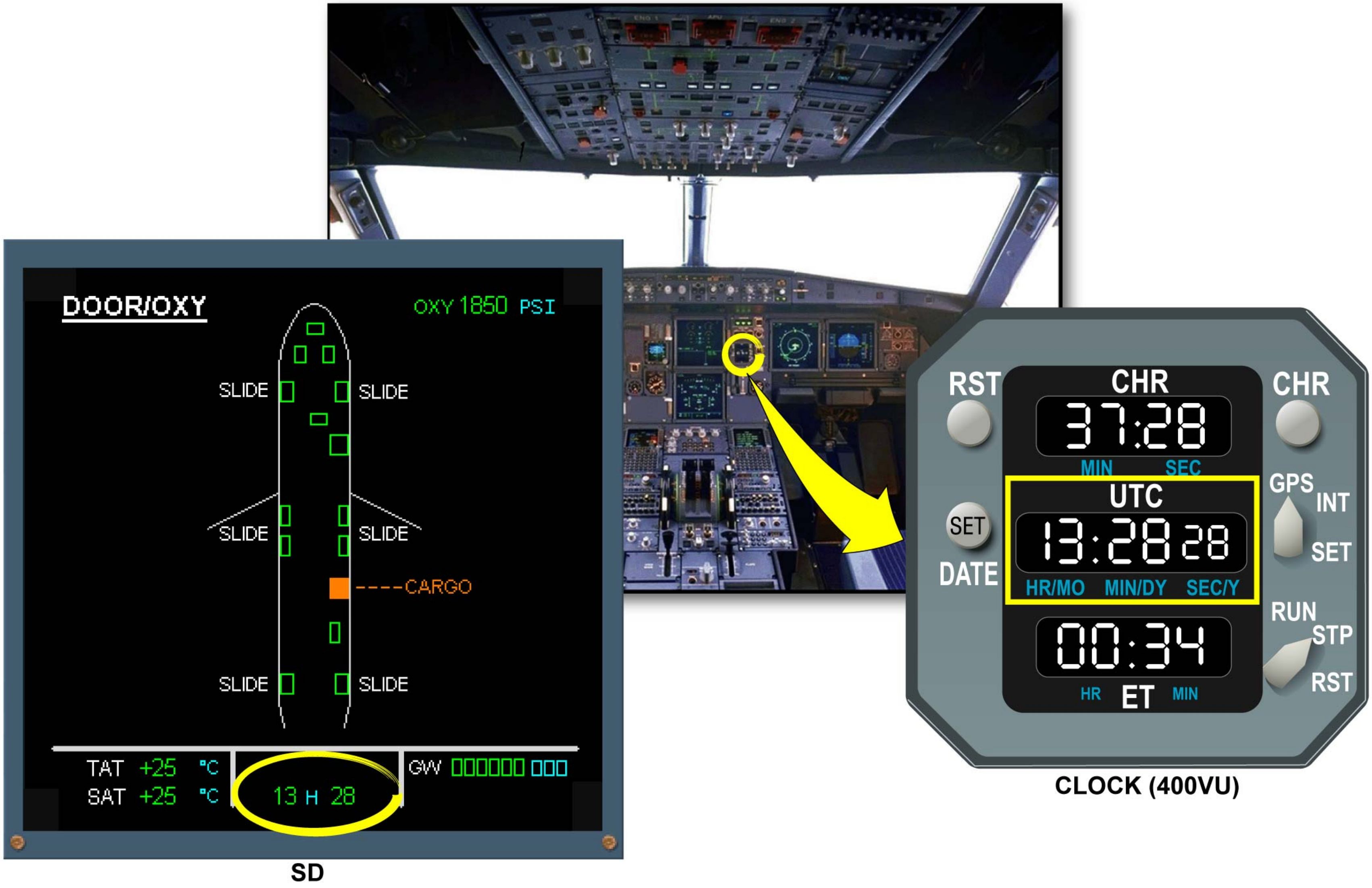


ELECTRONIC INSTRUMENT SYSTEM - EFIS CONTROL AND INDICATING

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

CLOCK

A single electrical clock gives the Universal Time Coordinated (UTC) and date as time references for the crew and all peripheral systems. The other functions available for crew are Elapsed Time (ET) and chronometer. The clock can be synchronized with satellite GPS time. The time is also displayed at the bottom of the SD.



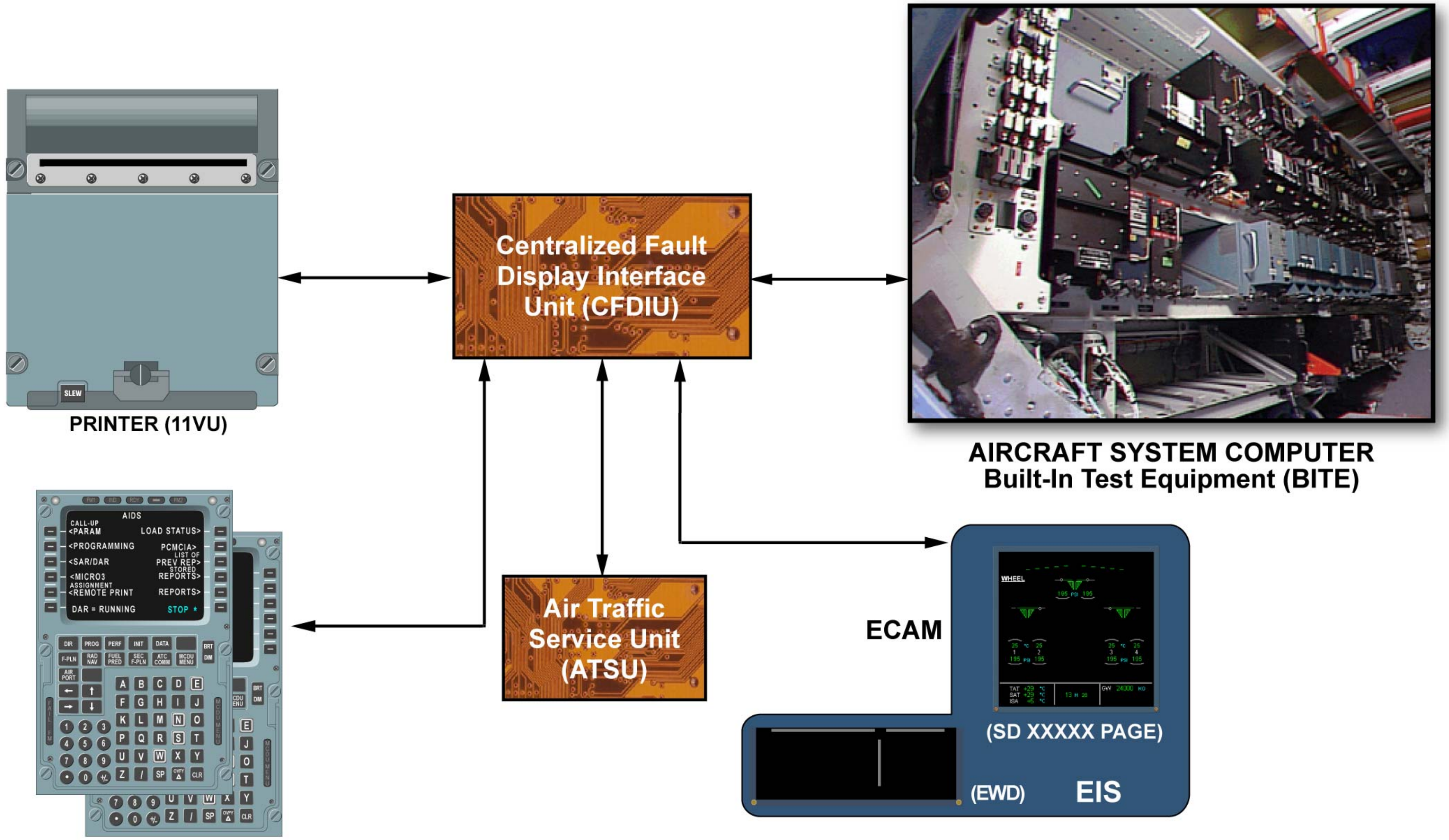
U7Z08431 - U0OT4T0 - UM31PZ000000002

CLOCK

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

CENTRALIZED FAULT DISPLAY SYSTEM

The Centralized Fault Display Interface Unit (CFDIU) centralizes and memorizes all information concerning A/C system failures. Reading or printing of the failure information is done in the cockpit with any MCDU or the printer. Most A/C system computers have a BITE. The BITE permanently monitors the system operation. When a failure is detected, it is stored in the BITE memory and is transmitted to the CFDIU. The ECAM, which generate warning and status messages, delivers these data to the CFDIU as well.
The failure information is available in various reports. The reading of the failure information is made from two different MCDU menus depending on if the A/C is in flight or on ground. The SYSTEM REPORT/TEST function is available on ground only. It enables a dialogue between the CFDIU and a system computer. The SYSTEM REPORT/TEST menu page presents the list of all the systems connected to the CFDIU, in ATA chapter order.
The maintenance Post Flight Report (PFR) can only be printed on ground. It summarizes and displays the list of the ECAM warning messages and the fault messages that occurred during the last flight, with the associated time, flight phase and ATA reference. It helps the maintenance crew to make a correlation for easier troubleshooting.



CENTRALIZED FAULT DISPLAY SYSTEM

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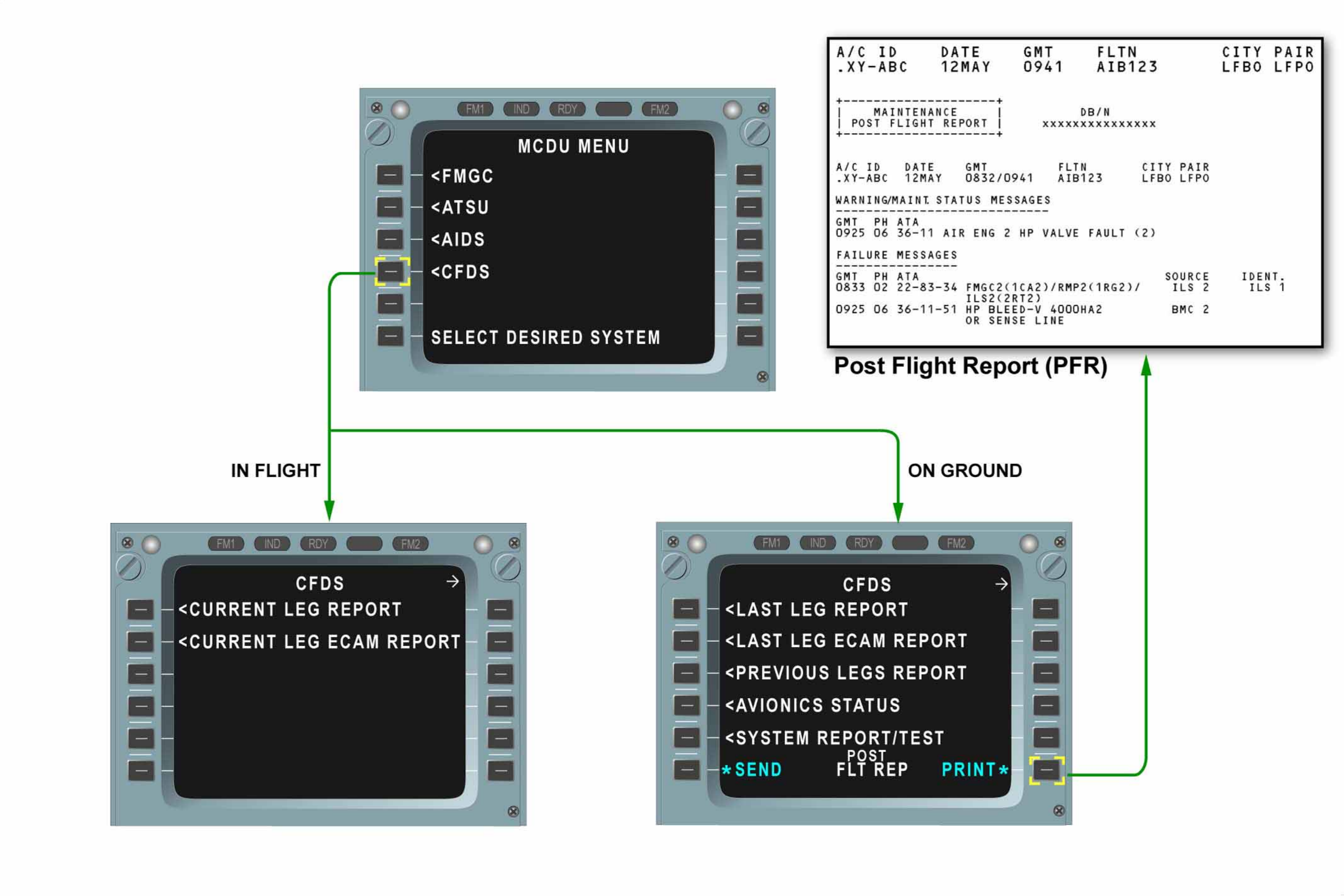

CENTRALIZED FAULT DISPLAY SYSTEM

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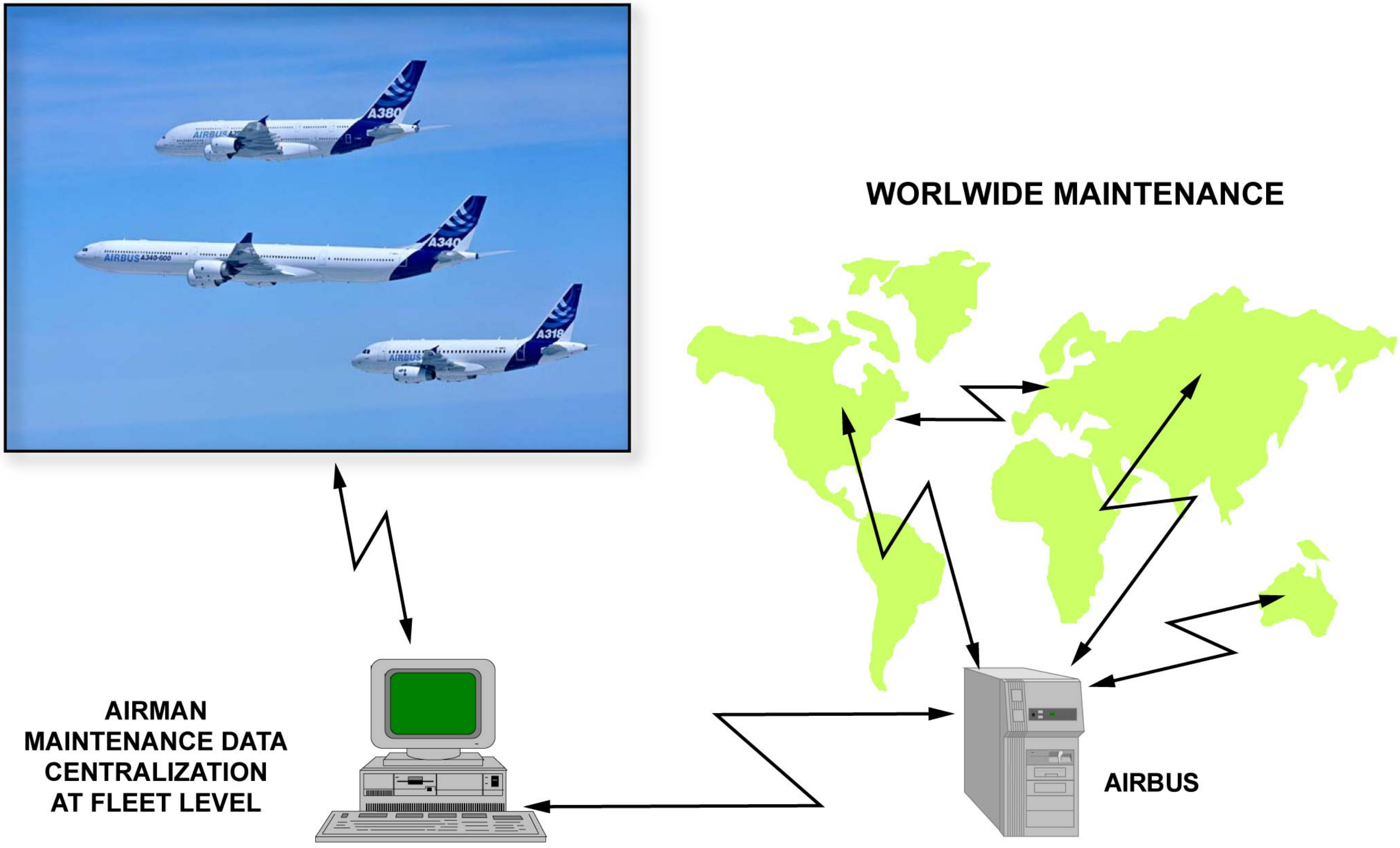
31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

AIRMAN (OPTION)

AIRMAN is a ground-based software dedicated to the identification and the management of unscheduled maintenance.
AIRMAN receives and analyses the aircraft status information generated by the Onboard Maintenance System (OMS) and also e-logbook data. The information is automatically transmitted to the ground by the aircraft's communication system.
These information sources are synthesized, combined with Airbus's and the Airline's own technical documentation and presented through a user-friendly interface. Aircraft status information is sent to AIRMAN while the aircraft is both in flight and on ground. Message analysis also takes place in real-time.
These capabilities maximize the time available for appropriate maintenance actions to be determined and preparations to be made.
AIRMAN is capable of analyzing an aircraft's fault history and consequently identifying and prioritizing preventive maintenance actions.
The aircraft maintenance philosophy is based on the following steps:
- fault detection made by the computers BITEs
- cockpit effects as flags on Display Units, and warning generated by the Flight Warning System (FWS)
- centralization and correlation by the Onboard Maintenance System (OMS) of BITE faults, cockpit effects and related maintenance procedures generation of Post Flight Report (PFR)
- fault event data reporting through the eLogbook
- fault event data and reports transmission to AIRMAN for maintenance support on ground



AIRMAN (OPTION)

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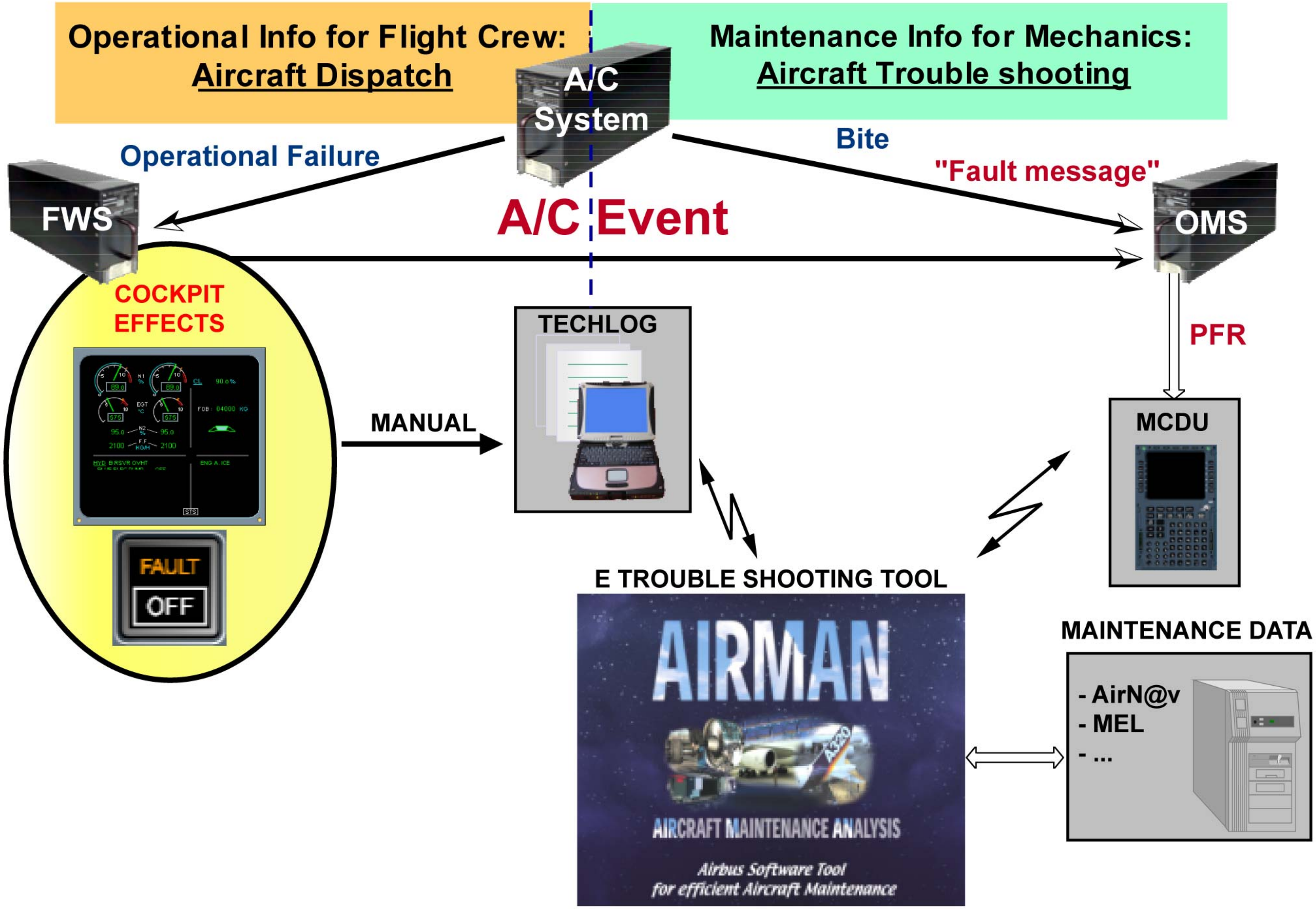

AIRMAN (OPTION)

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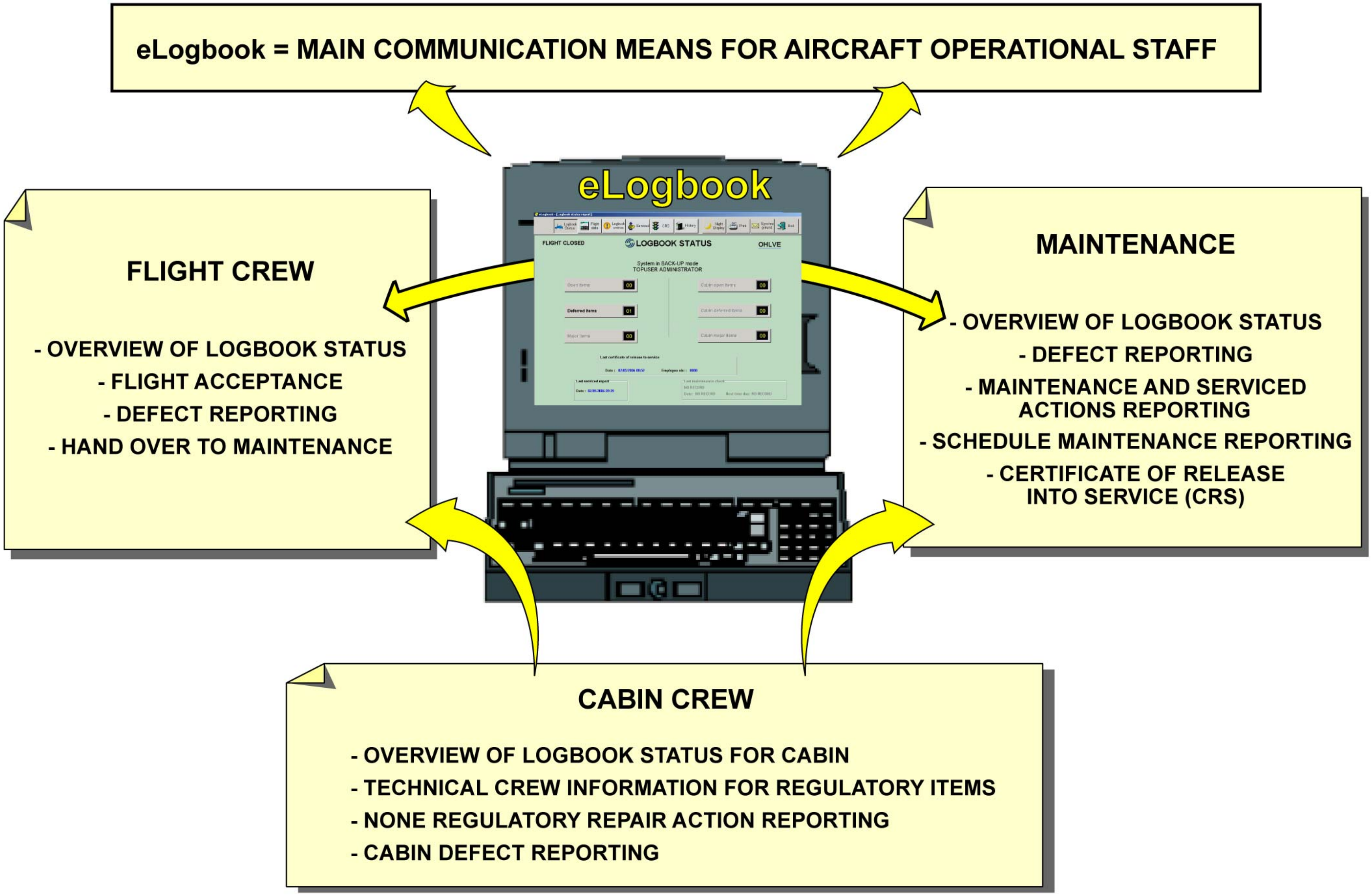
31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

AIRMAN (OPTION) (continued)

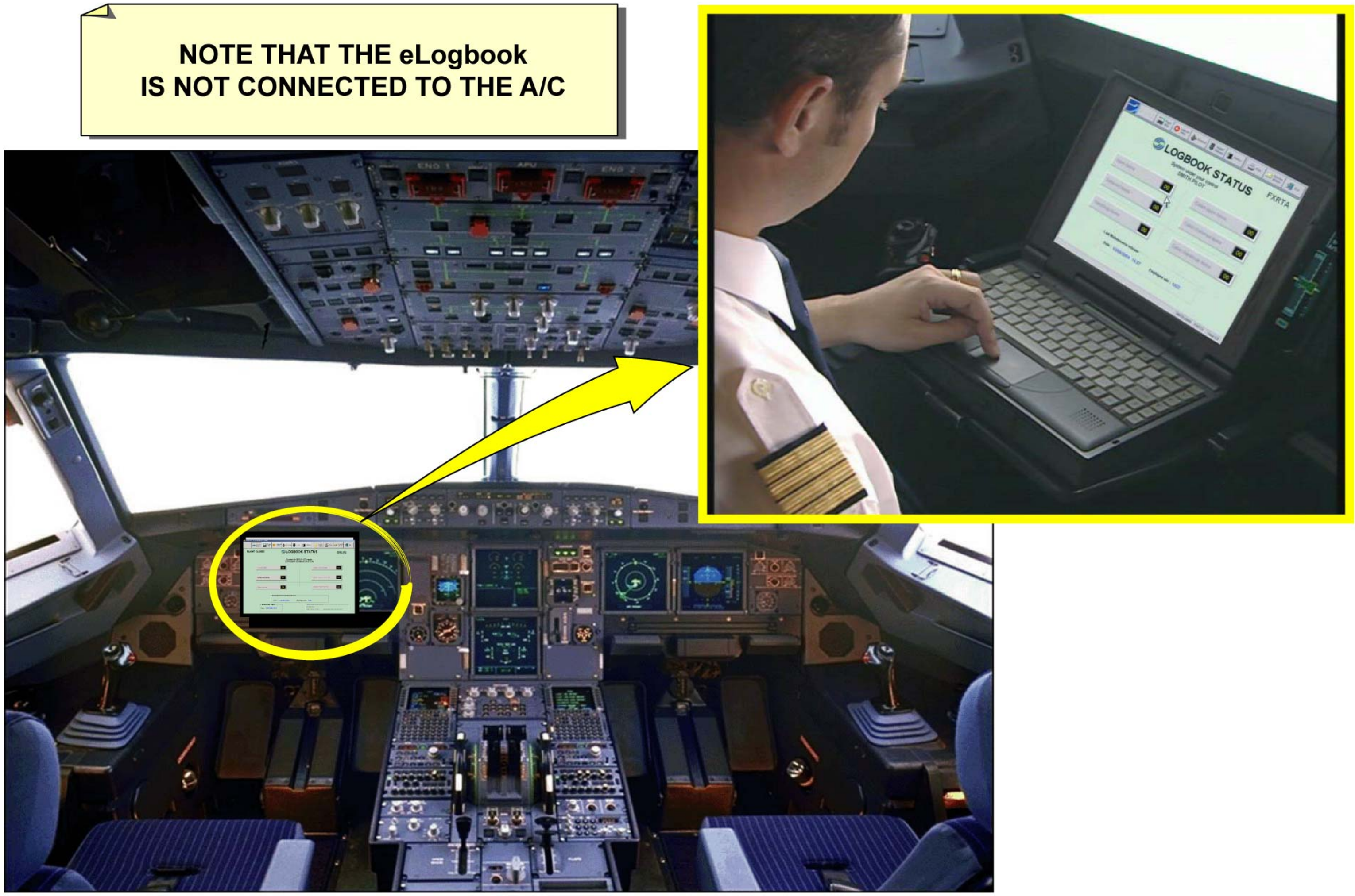
ELOGBOOK

The eLogbook is the main communication means for aircraft operational staff. It enables the flight crew and the technical staff to be aware of the aircraft status, to enter aircraft defect and to report maintenance and servicing actions.
The eLogbook lets the flight crew:
o consult the Logbook status
o accept / create a new flight
o report aircraft defects
o hand over to maintenance
The maintenance staff uses the eLogbook to:
o consult the aircraft status
o report aircraft defects
o report corrective or scheduled maintenance actions
o report servicing actions
o build the Certificate of Release into Service (CRS) of the aircraft
Finally the cabin crew can also use the eLogbook to:
o consult the aircraft status
o inform the flight crew about regulatory cabin defects
o report none regulatory cabin defects
The eLogbook runs on a fully stand-alone laptop and is not connected to the aircraft. The eLogbook is stowed in the cockpit by the flight crew.



AIRMAN (OPTION) - ELOGBOOK

U7Z08431 - U0OT4T0 - UM31PZ000000002



AIRMAN (OPTION) - ELOGBOOK

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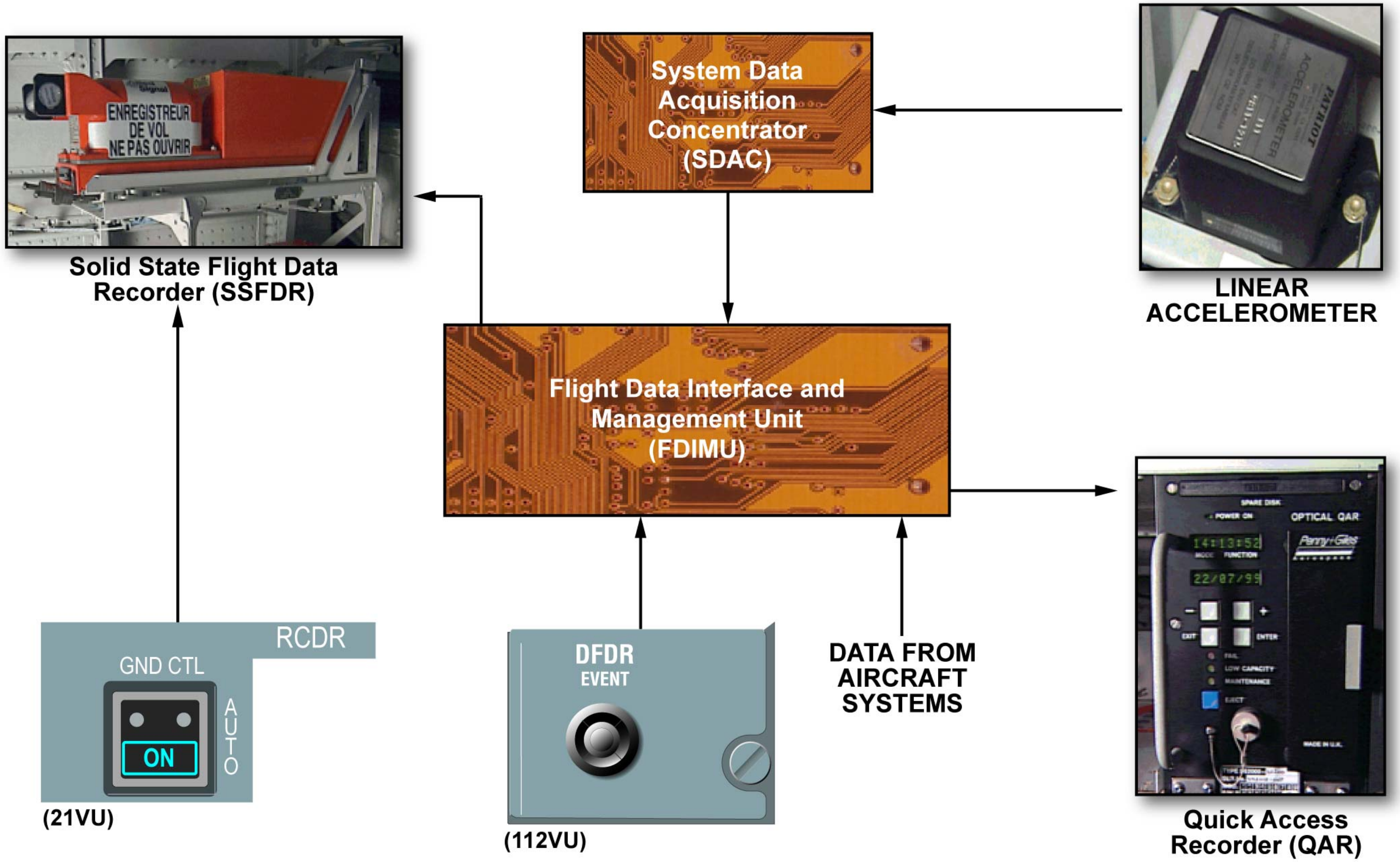
31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

DIGITAL FLIGHT DATA RECORDING

The Flight Data Interface and Management Unit (FDIMU) has two primary functions. The first of which is the Flight Data Interface Unit (FDIU) function.
To fulfill the mandatory requirements of crash recording, the FDIU acquires and formats various critical flight parameters and system data before supplying the Solid State Flight Data Recorder (SSFDR).
The linear accelerometer measures the acceleration of the A/C in all three axes. The System Data Acquisition Concentrator (SDAC) digitizes the analog signal of the linear accelerometer and sends it to the FDIU.
For maintenance and performance purposes, the optional Quick Access Recorder (QAR) records the same parameters as the SSFDR. The operation of the SSFDR is automatic.
On the overhead panel, there is a GrouND ConTroL P/B located on the ReCorDeR panel. This P/B lets the SSFDR be supplied when the A/C is on ground for preflight checks before engine start or for test and maintenance purposes. On the center pedestal, there is a Digital Flight Data Recorder (DFDR) EVENT P/B, which can be used to set an event mark on the SSFDR memory.



DIGITAL FLIGHT DATA RECORDING

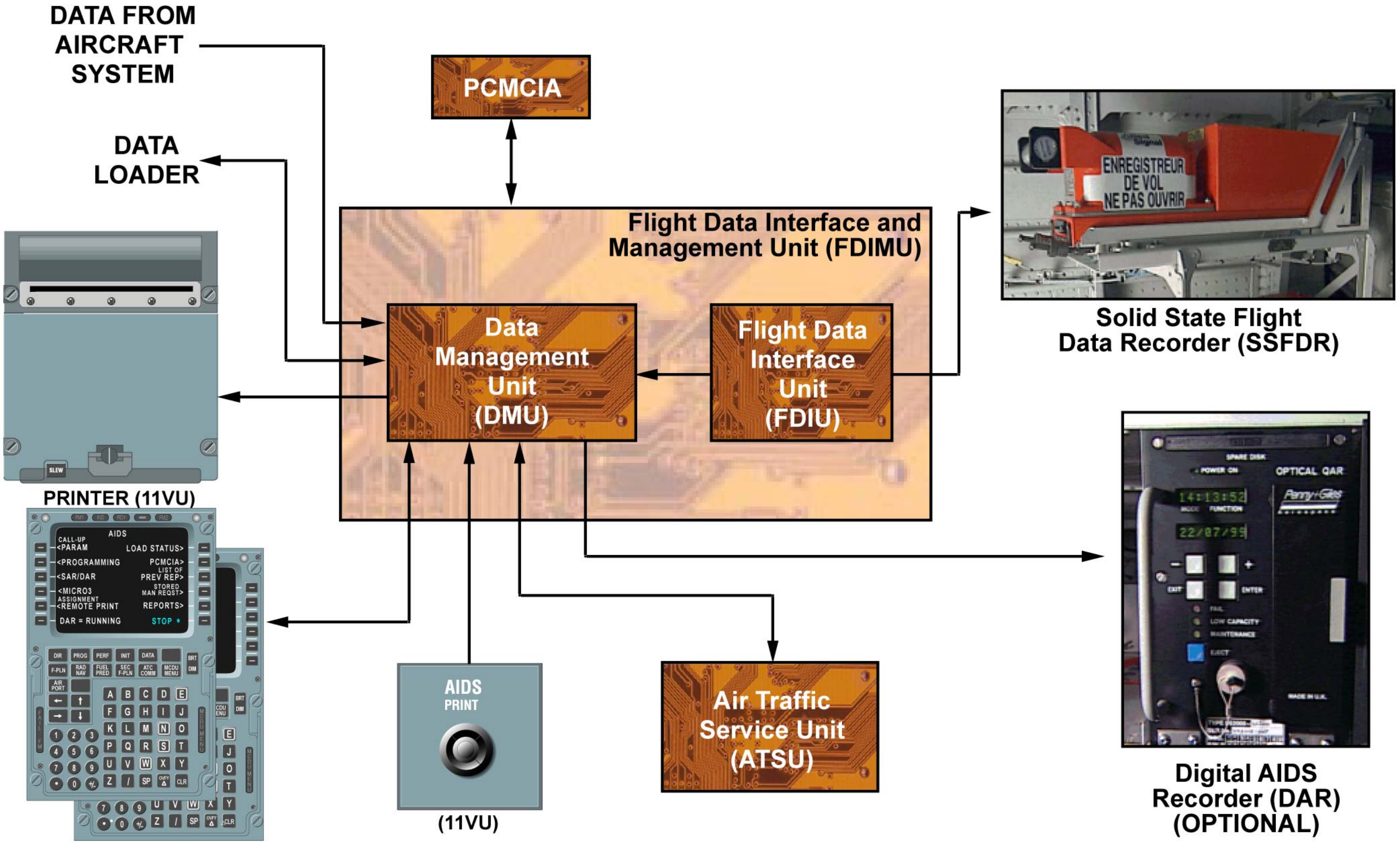
U7Z08431 - U0OT4T0 - UM31PZ000000002

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

AIRCRAFT INTEGRATED DATA SYSTEM

The main functions of the Aircraft Integrated Data System (AIDS) are to monitor engine condition, APU condition and A/C performance, and to provide trouble shooting assistance. The second main function of the FDIMU is the DMU function which houses the Aircraft Integrated Data System (AIDS).
The Data Management Unit (DMU) is the heart of the AIDS. It fulfils the following functions:
- collection, processing and recording of various A/C parameters, including the mandatory parameters given by the FDIU. The recording is made in an internal memory of the DMU and on an optional external recorder called Digital AIDS Recorder (DAR),
- generate various reports according to defined conditions. These reports are stored in a non-volatile memory of the DMU.

A data loader is used to upload programmed data into the DMU and to download recorded DMU data on a floppy disk for on ground analysis.
The printer is used to print reports generated by the DMU.
The printer can be automatically controlled by the DMU, manually controlled from the MCDU or using the AIDS PRINT P/B on the center pedestal.
The FDMIU has a PCMCIA card slot to upload DMU software and download DMU data.
In the A/C, two MCDUs are connected to the DMU.
To initiate communication with the AIDS via either MCDU, the user has to press the AIDS line select key from the MCDU MENU page. The AIDS MCDU menu page is then displayed.
Some of the AIDS functions, including real time parameter read out, may be controlled from this menu.



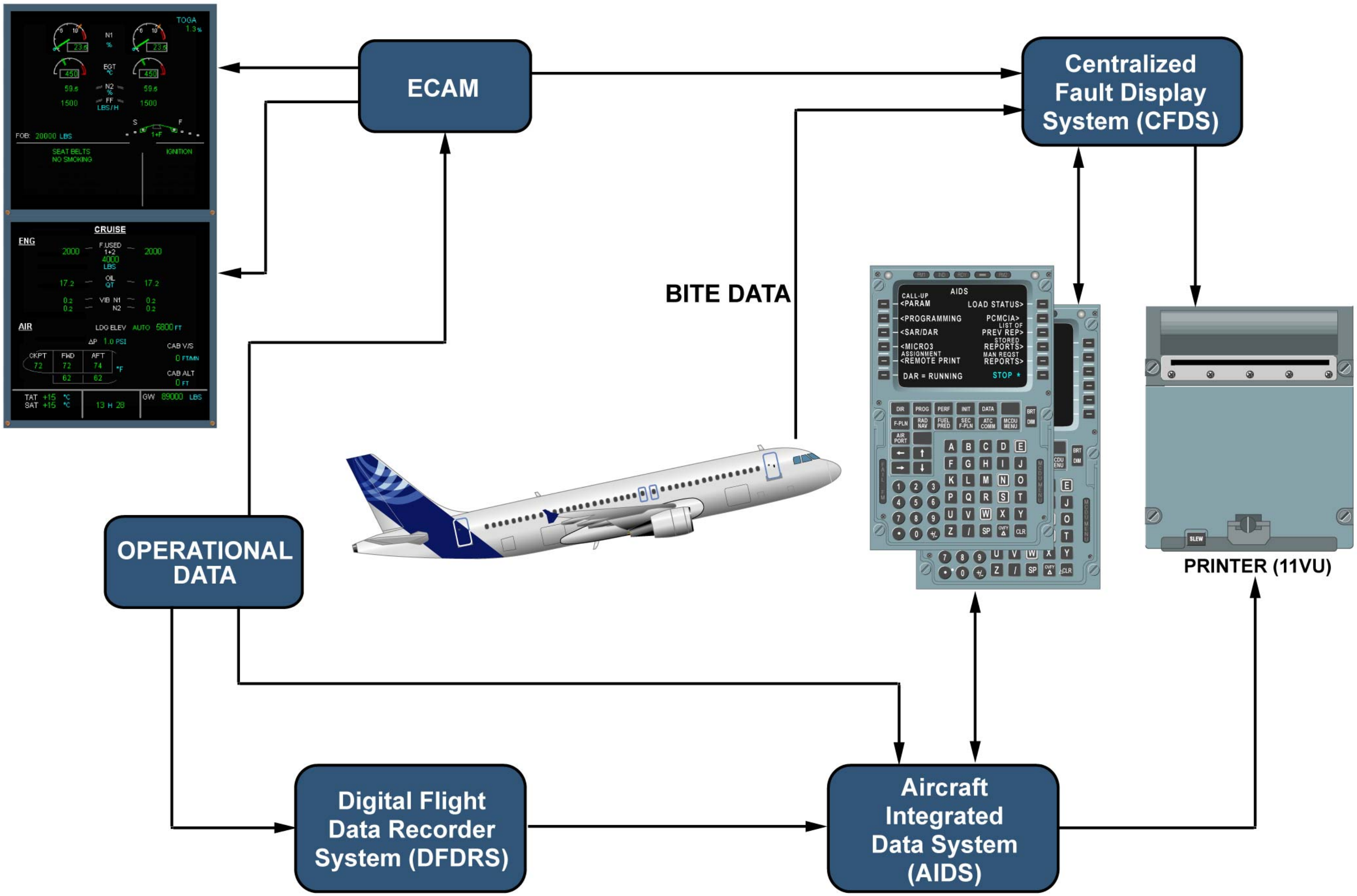
AIRCRAFT INTEGRATED DATA SYSTEM

U7Z08431 - U0OT4T0 - UM31PZ000000002

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

ON BOARD MAINTENANCE FACILITIES

In this graphic all the indicating/recording systems can be seen together.



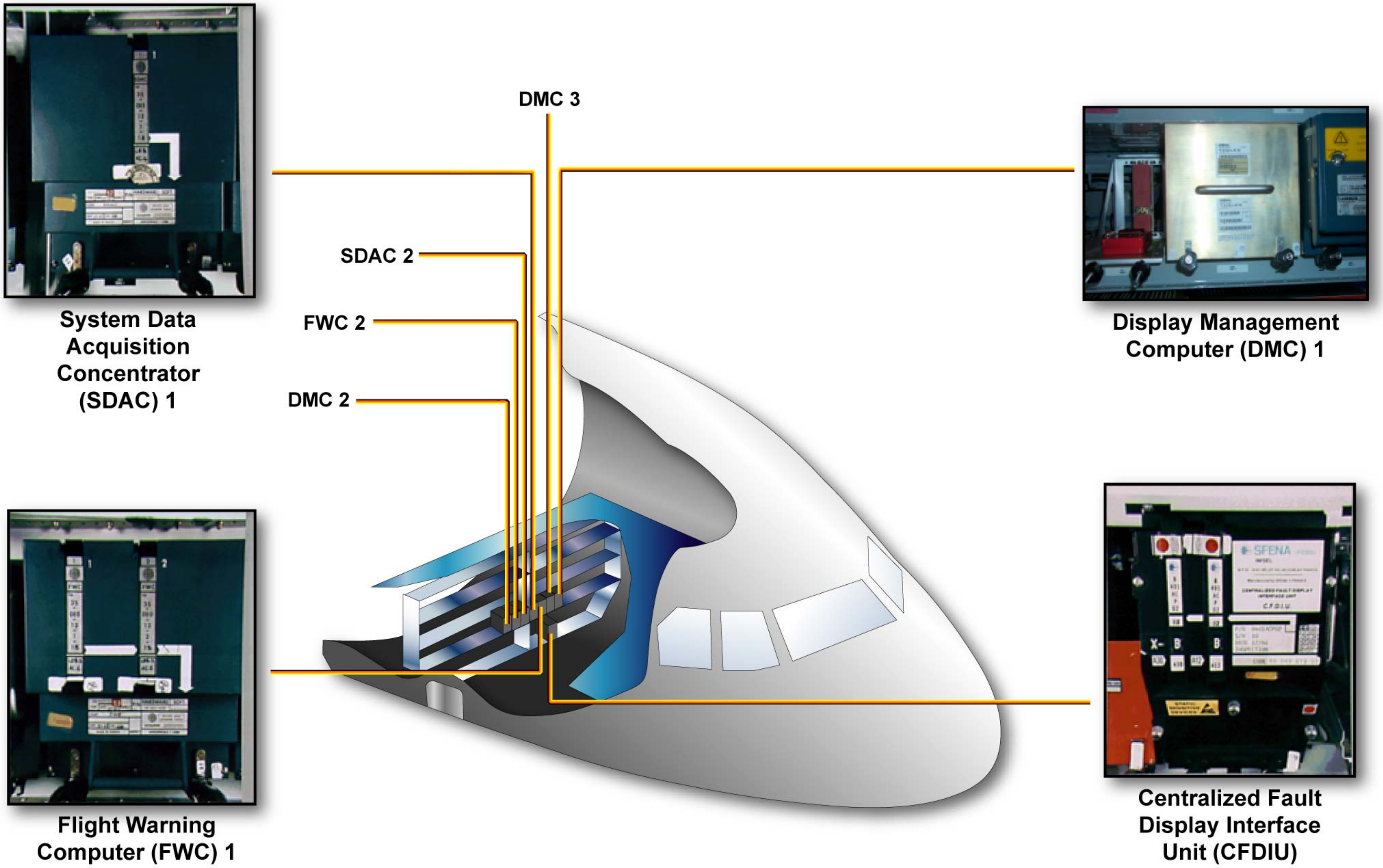
ON BOARD MAINTENANCE FACILITIES

U7Z08431 - U0OT4T0 - UM31PZ000000002

31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

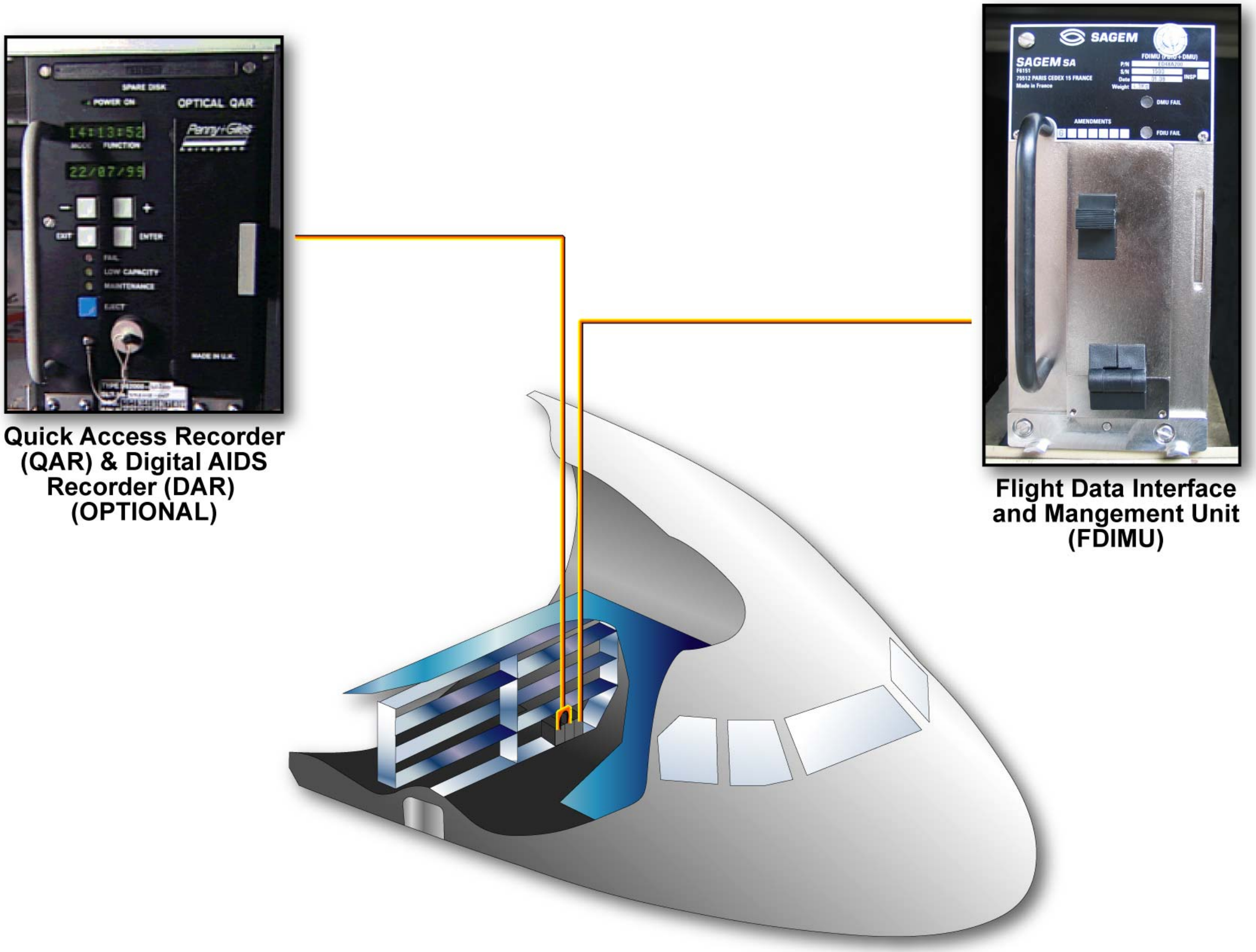
COMPONENT LOCATION

The EIS and the Centralized Fault Display System (CFDS) computers are located in the aft avionics rack.
The DFDRS and AIDS computers are located in the aft avionics rack.
Concerning the QAR/DAR, there are several vendors of optical disk storage media. The recorder is then called Optical QAR/DAR (OQAR/ODAR).
Also there is a version from Teledyne that is equipped with a GSM module for data transmission called WQAR (Wireless GroundLink QAR).
The FDIMU computer is located in the aft avionics rack.
The SSFDR is installed, just above the Cockpit Voice Recorder (CVR), in an unpressurized area of the rear fuselage.
The SSFDR stores, in a solid state memory located in a crash and fire protected housing, the data of the last 25 hours collected by the FDIU.
The linear accelerometer is near the A/C center of gravity.
It sends the accelerations according to the 3 axis (pitch, roll and yaw) to the DFDRS.



COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM31PZ000000002



COMPONENT LOCATION

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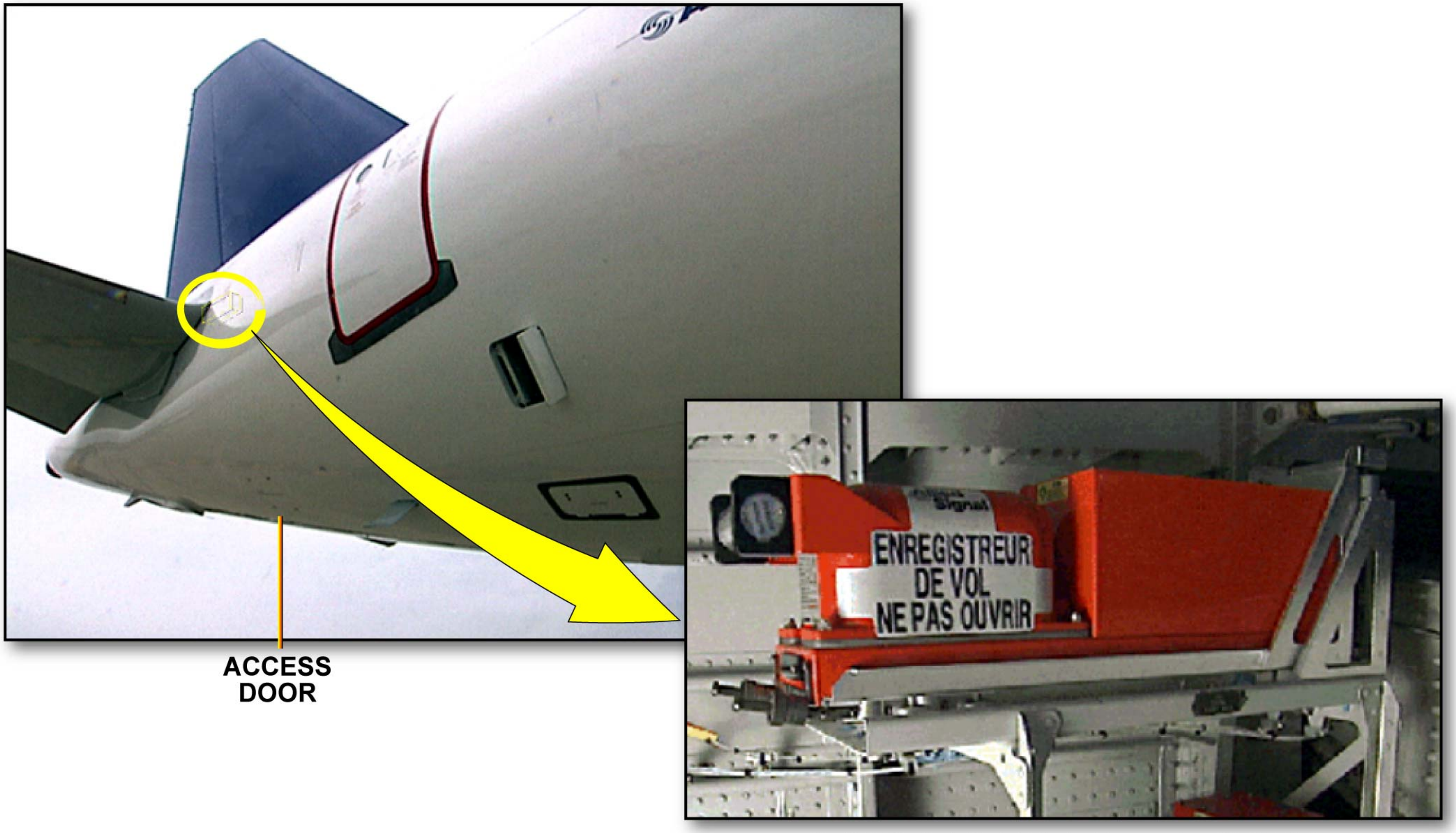

COMPONENT LOCATION

LINEAR ACCELEROMETER

U7Z08431 - U0OT4T0 - UM31PZ000000002

COMPONENT LOCATION

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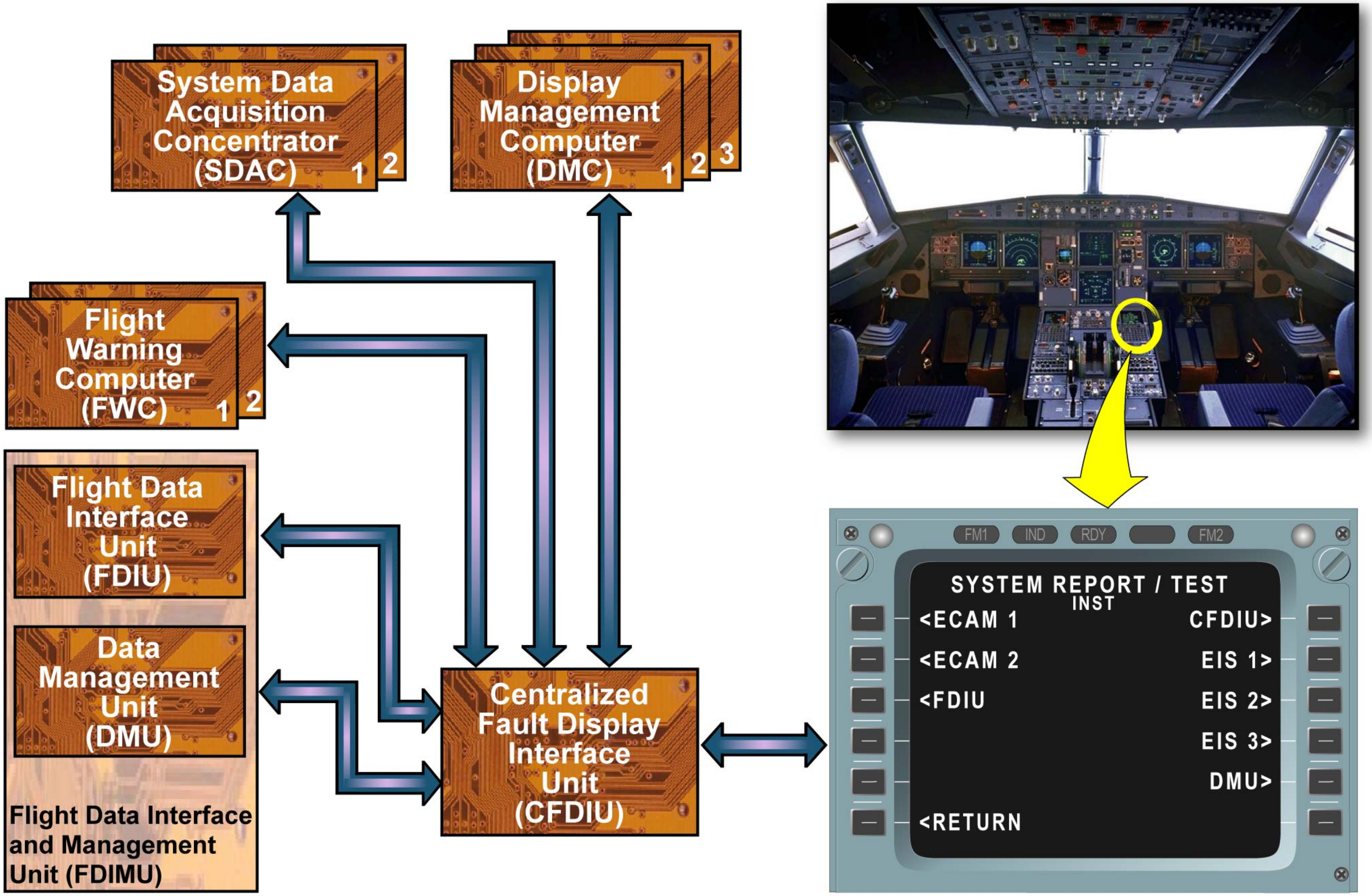
31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

Using the MCDU, you can have access to the CFDS fault messages of all the indicating/recording systems.
Specific BITE tests are available as well.
ECAM 1 and 2 gives access to FWC 1/2, SDAC 1/2 and ECAM control panel.
EIS 1 gives access to DMC 1, PFD 1, ND 1, Upper ECAM and Lower ECAM.
EIS 2 gives access to DMC 2, PFD 2 and ND 2.
EIS 3 gives access to DMC 3.



MAINTENANCE/TEST FACILITIES

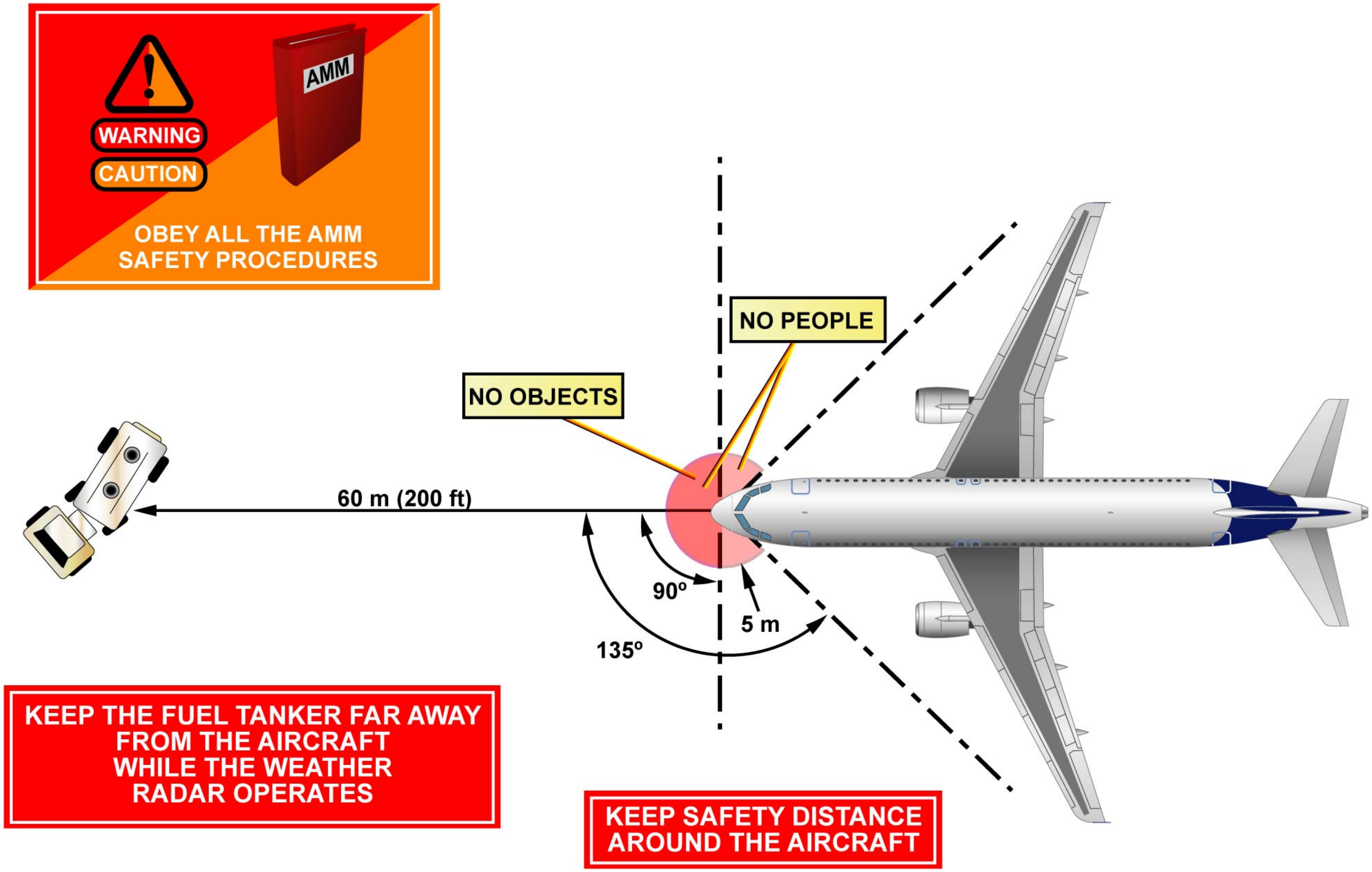
31 INDICATING/RECORDING SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

Make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures during some Indicating test due to weather radar operation.
Make sure that:
- all persons are more than 5 meters away from the weather radar antenna in the area made by an arc of 135 degrees on each side of the A/C centerline,
- all objects and obstacles are more than 5 meters away from the antenna in the area made by an arc of 90 degrees on each side of the A/C centerline.

Stop the fuel tanker 60 meters from the A/C nose while the weather radar operates. Do not operate the fuel tanker/pump until you stop the operation of the weather radar.

U7Z08431 - U0OT4T0 - UM31PZ000000002



SAFETY PRECAUTIONS

U7Z08431 - U0OT4T0 - UM31PZ000000002

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

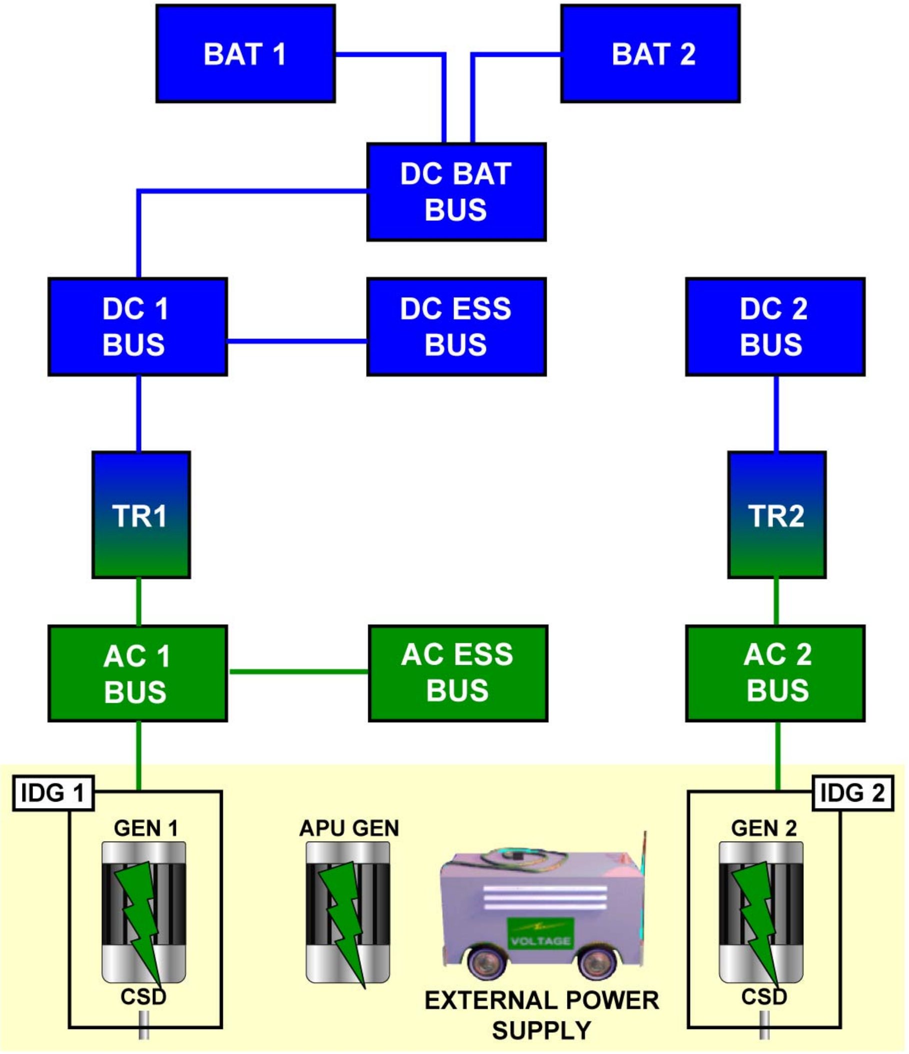
GENERAL

There are two identical engine driven generators called Integrated Drive Generators (IDGs). They are used as the main power source to supply the A/C electrical network.
The IDG basically contains, in a common housing, a generator and a Constant Speed Drive (CSD). The CSD gives a constant input speed to the generator, which is required for a constant output frequency.
Each generator supplies 115V 400Hz AC to its own bus:
- generator 1 supplies AC bus 1,
- generator 2 supplies AC bus 2.

This supply is known as split operation, which means that the AC power sources are never connected in parallel.
Each AC bus supplies a Transformer Rectifier (TR):
- AC bus 1 supplies TR 1,
- AC bus 2 supplies TR 2.

The TRs convert 115V AC into 28V DC to supply their associated DC buses, DC 1 and DC 2.
DC bus 1 then supplies the DC BAT bus.
The DC battery bus can charge the batteries or receive power from the batteries as a backup supply, if no other power sources are available.
The electrical system also includes two ESSential (ESS) Buses. One is the AC ESS bus fed by AC bus 1 and the other is the DC ESS bus fed by DC bus 1. These buses are used to supply the most critical A/C systems.
This is the basic electrical system. We will now introduce some other components, which also supply the system.
The entire electrical network can also be supplied by the APU generator.
On the ground, the aircraft electrical network can be supplied by an external power source.
Any one of the power sources can supply the entire electrical network.
As no parallel connection is allowed on this A/C (split operation), we have to give priorities to the different power sources in supplying the bus bars.
AC 1 and AC 2 buses are supplied in priority by their own side generator, then the external power, then the APU generator and then by the opposite generator.

Integrated Drive Generator (IDG)
Constant Speed Drive (CSD)
Transformer Rectifier (TR)
Battery (BAT)
Essential (ESS)
Generator (GEN)



GENERAL

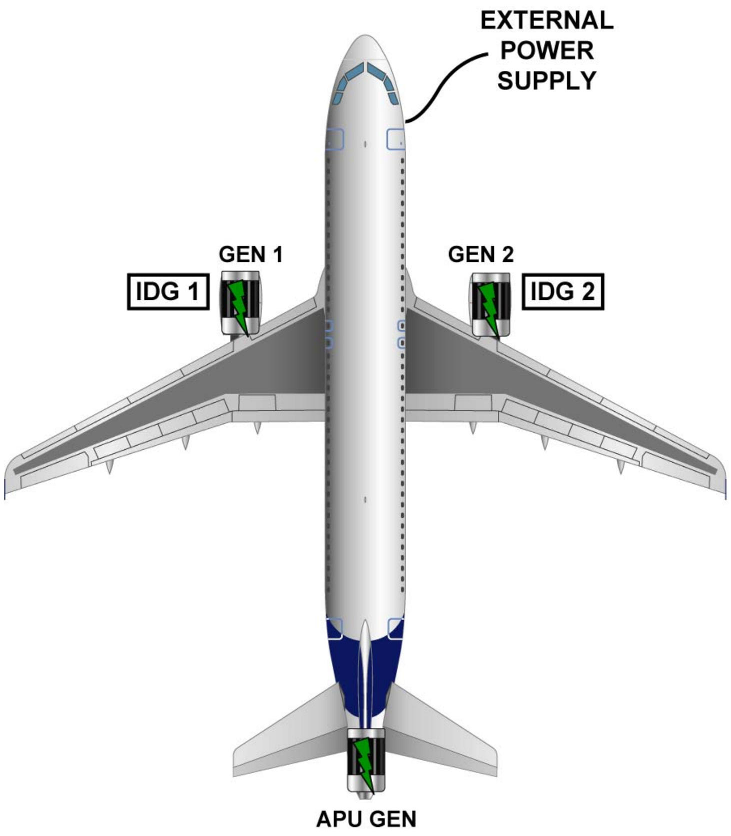
U7Z08431 - U0OT4T0 - UM24PZ000000002

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

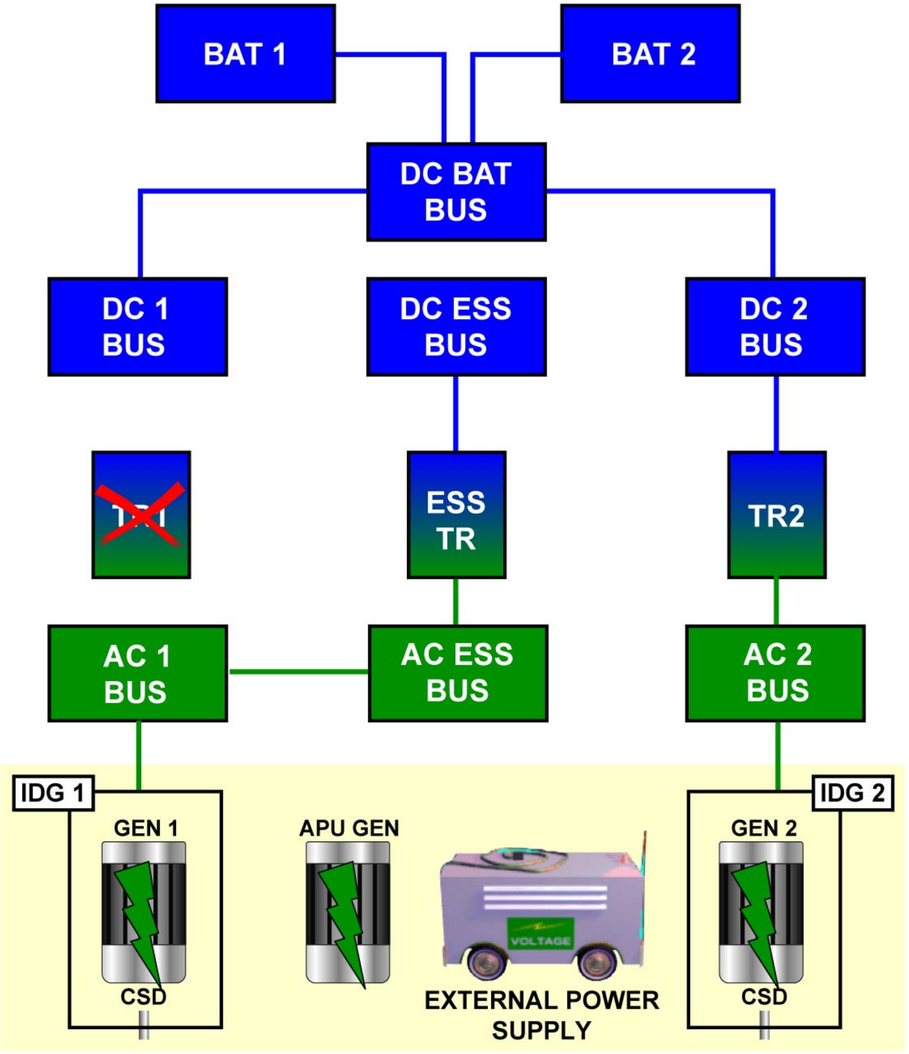
GENERAL (continued)

ABNORMAL CONFIGURATION

The electrical system has an ESS TR, which supplies the DC ESS Bus in abnormal or emergency configuration.
In abnormal configuration (loss of TR1 or TR2) the ESS TR is supplied by the AC ESS Bus.



Integrated Drive Generator (IDG)
Constant Speed Drive (CSD)
Transformer Rectifier (TR)
Battery (BAT)
Essential (ESS)
Generator (GEN)



GENERAL - ABNORMAL CONFIGURATION

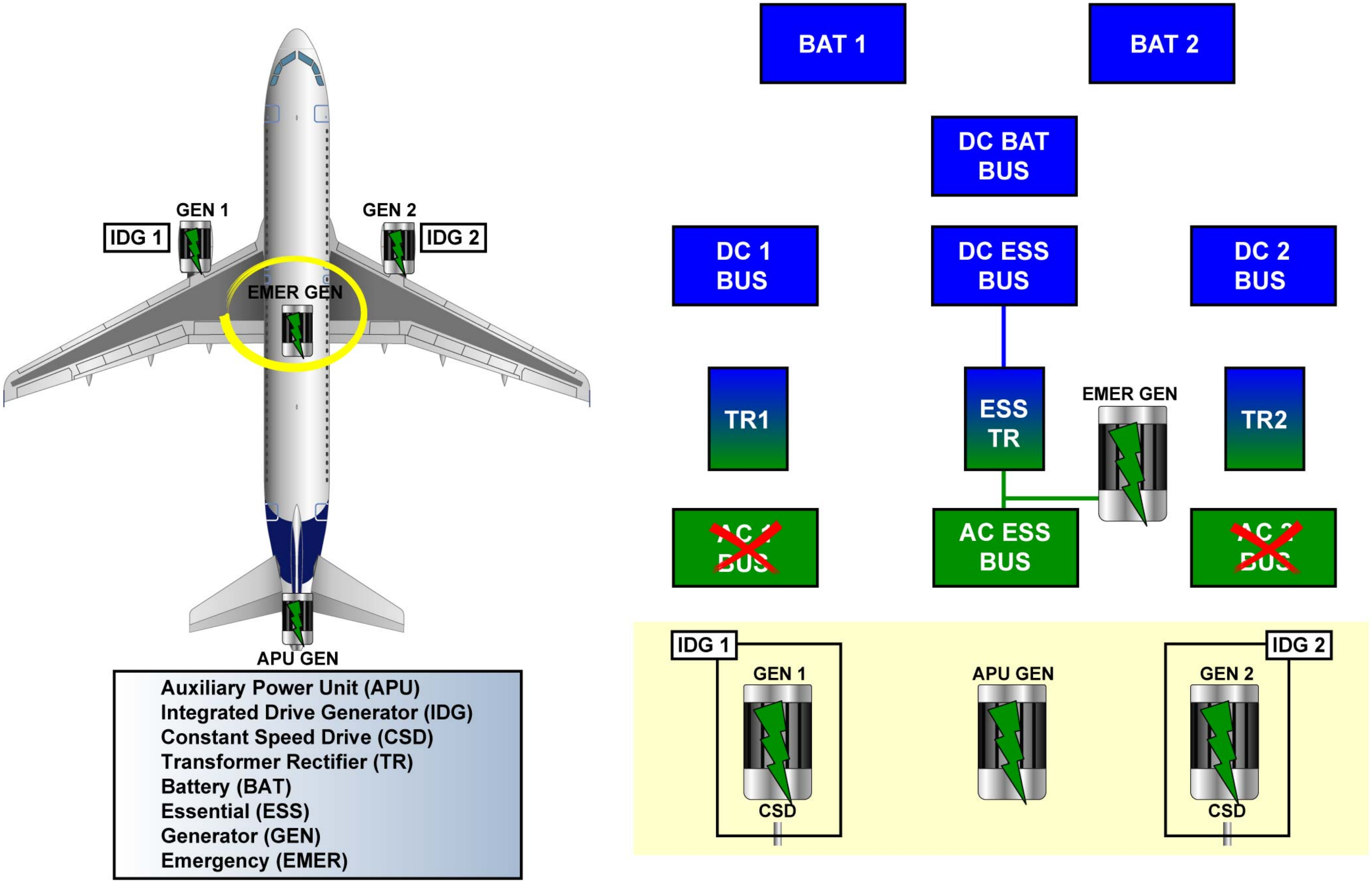
U7Z08431 - U0OT4T0 - UM24PZ000000002

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

GENERAL (continued)

EMERGENCY CONFIGURATION

In the event of emergency operation, the Emergency Generator (EMER GEN) supplies the A/C with electrical power. The EMER GEN needs hydraulic power to operate. This hydraulic power to drive the EMER GEN is supplied by the Blue Hydraulic system via the Ram Air Turbine (RAT). The RAT is located in the belly fairing and extends automatically when AC BUS 1 and 2 have no voltage supply.
The RAT is in the belly fairing and extends automatically in case of loss of AC BUS 1 and 2. Then, the EMER GEN supplies the DC ESS through AC ESS directly TR. In emergency configuration (loss of AC BUS 1 and AC BUS 2), the EMER GEN supplies the ESS TR.



GENERAL - EMERGENCY CONFIGURATION

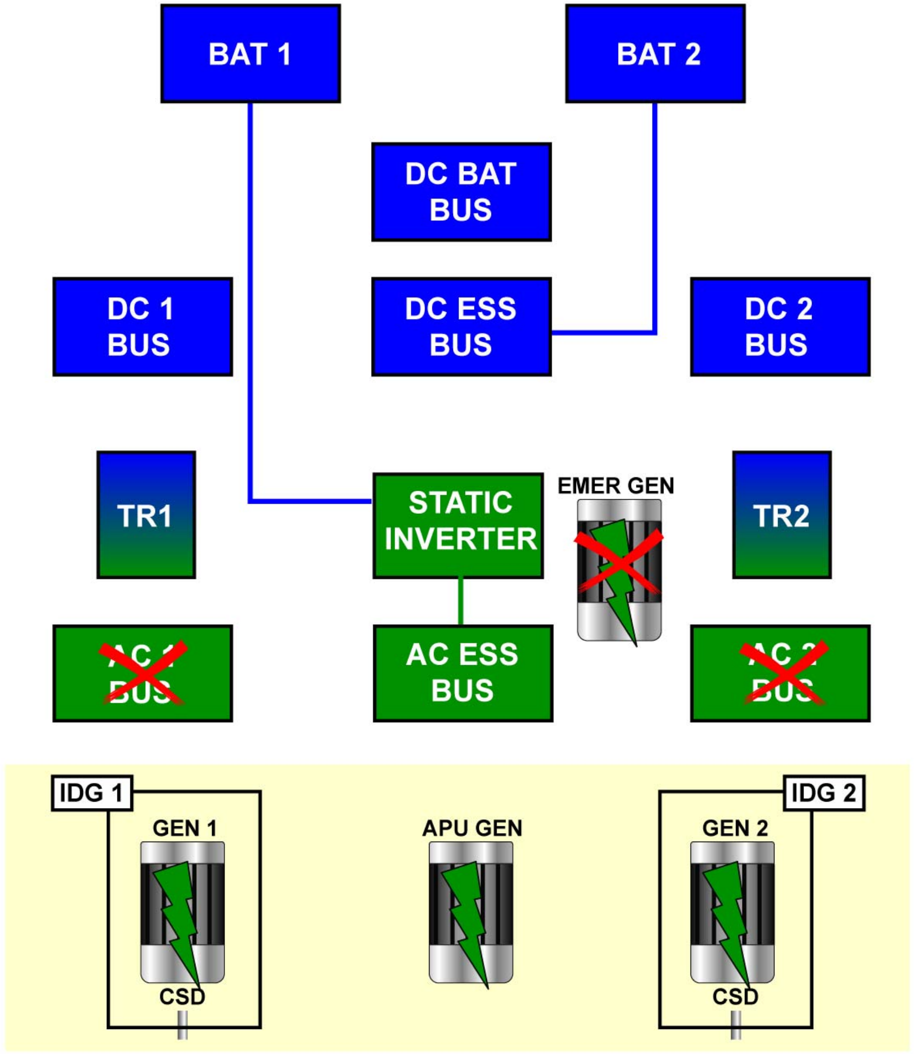
24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

GENERAL (continued)

BATTERY ONLY CONFIGURATION

In emergency configuration with emergency generator not available, BAT 1 supplies the AC ESS BUS via the static inverter and BAT 2 supplies the DC ESS BUS.

Auxiliary Power Unit (APU)
Integrated Drive Generator (IDG)
Constant Speed Drive (CSD)
Transformer Rectifier (TR)
Battery (BAT)
Essential (ESS)
Generator (GEN)
Emergency (EMER)

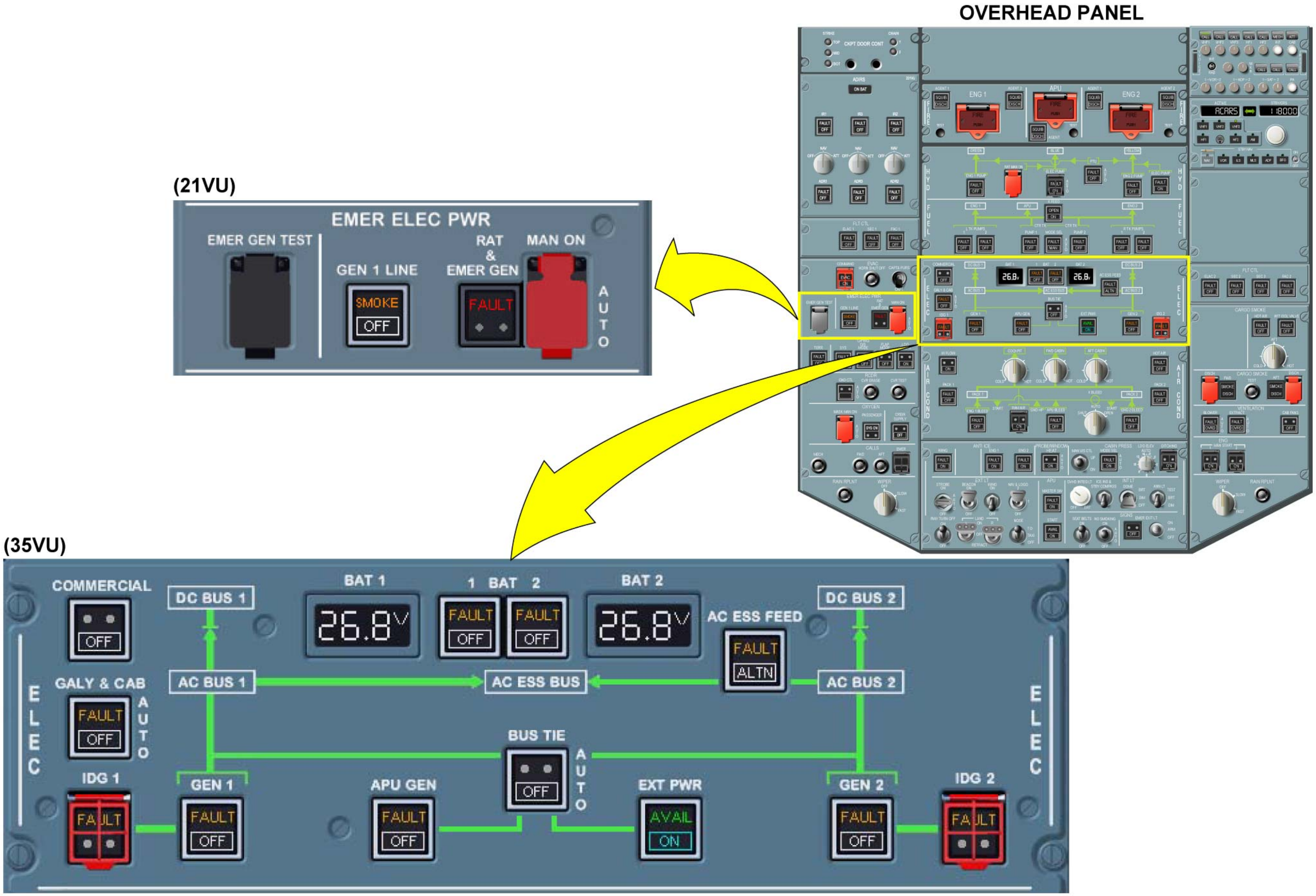


GENERAL - BATTERY ONLY CONFIGURATION

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

CONTROL AND INDICATING/PANEL LOCATION

The ELEC panel is installed on the overhead panel.
For emergency cases, there is an EMER ELEC PWR panel on the LH side of the overhead panel.



CONTROL AND INDICATING/PANEL LOCATION

U7Z08431 - U0OT4T0 - UM24PZ000000002

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

CONTROL AND INDICATING/PANEL LOCATION (continued)

MAIN PANEL/ECAM PAGE

The ECAM Electric System page shows all relevant data with regard to the entire A/C Electrical Power Generation and Distribution systems. The System page shown here is a normal configuration with main generators supplying the network.
The battery voltage can be monitored either on the overhead panel or the ECAM page. Each battery is controlled by a P/B Switch (SW).
Both main generators and the APU generator are controlled by their related P/B SW.
The external power is also controlled by a P/B SW.
The AC ESS FEED P/B SW lets the pilots change the supply to the AC ESS bus from AC bus 1 to AC bus 2.
When the BUS TIE P/B SW is in AUTO position, it lets the opening or closing of the bus tie contactors in order to supply the AC 1 and AC 2 buses according to the power supply priorities.
When OFF, both bus tie contactors open to isolate one side of the network from the other (e.g.: smoke configuration).
In case of failure, the IDG P/B SWs disconnect the IDG from the engine gearbox.
The GALY & CAB P/B SW lets galleys and some sub-buses be manually shed.
The COMMERCIAL P/B SW is used for the shedding of all commercial loads including the GALY & CAB related buses.

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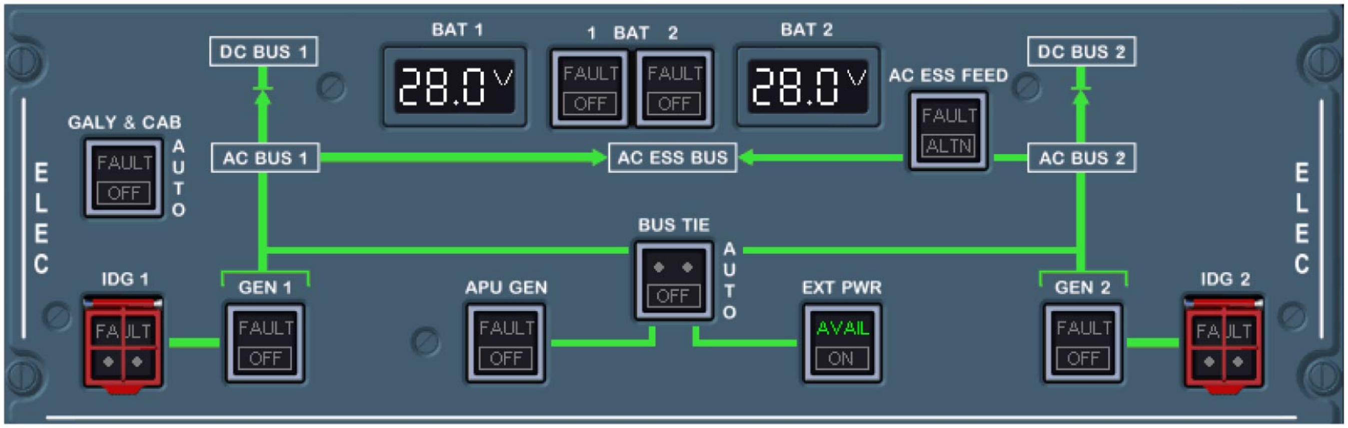
(35VU)



SD

CONTROL AND INDICATING/PANEL LOCATION - MAIN PANEL/ECAM PAGE

U7Z08431 - U0OT4T0 - UM24PZ000000002

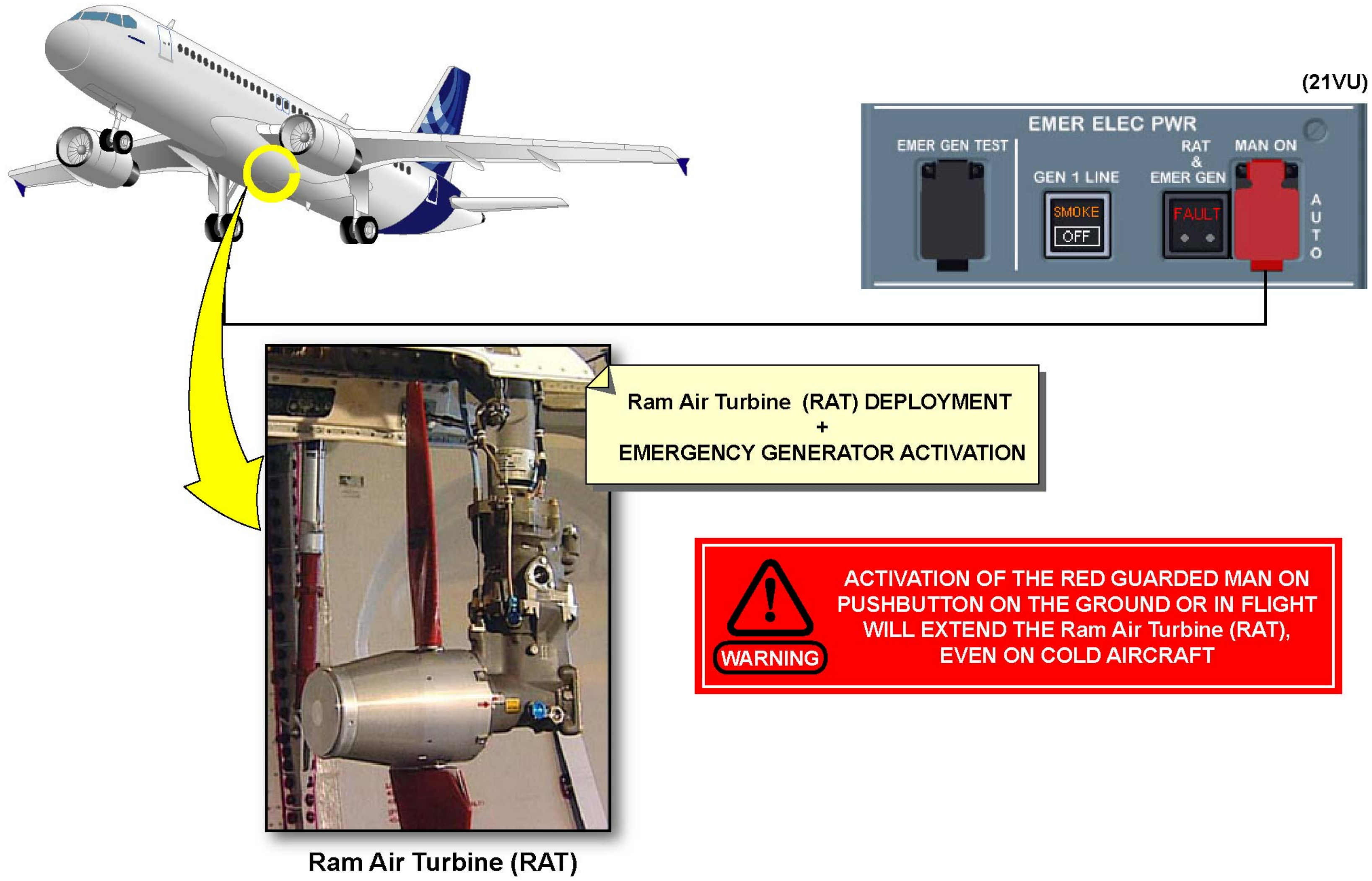
24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

CONTROL AND INDICATING/PANEL LOCATION (continued)

EMERGENCY PANEL

The EMER GEN TEST P/B is used on ground to test the EMERgency GENerator or the Static Inverter.
In avionics smoke condition, the GEN 1 LINE P/B disconnects the generator 1 from the busbar but the generator remains exited to supply some fuel pumps.
When AC BUS 1 and 2 are no longer supplied, the RAT will extend automatically to pressurize the blue hydraulic system, which powers the EMER GEN, if the A/C speed is sufficient.

WARNING: ACTIVATION OF THE RED GUARDED MAN ON PUSHBUTTON ON THE GROUND OR IN FLIGHT WILL EXTEND THE RAM AIR TURBINE (RAT), EVEN ON COLD AIRCRAFT.

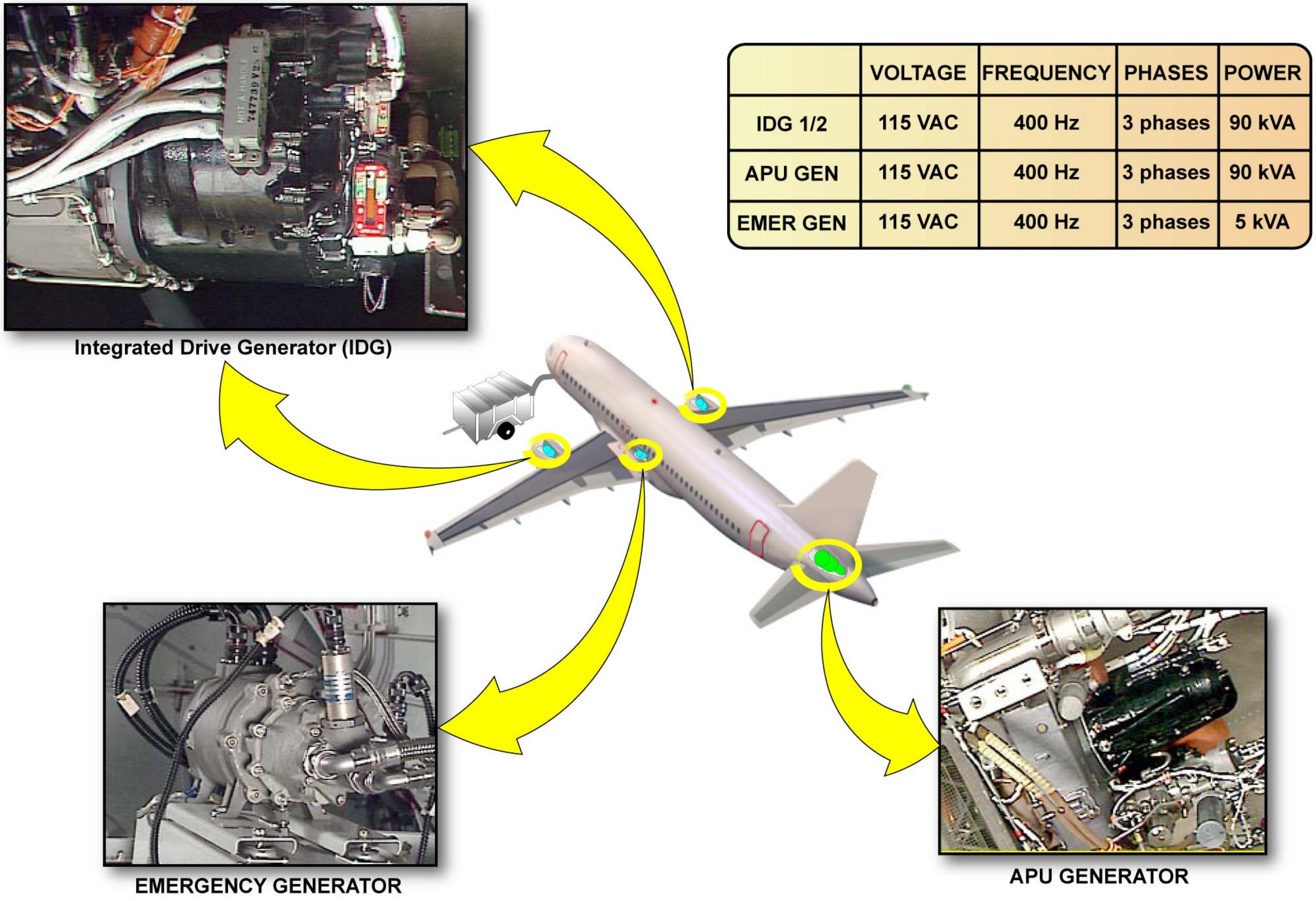


CONTROL AND INDICATING/PANEL LOCATION - EMERGENCY PANEL

24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

COMPONENT LOCATION

The AC generators provide a 115 VAC, 3-phase, 400 Hz AC supply. The IDGs and the APU have a nominal 90 kVA power whereas the EMER GEN has a 5 kVA output.
The static inverter converts the direct current from battery 1 into an AC current if no other source is available.
The Battery Charge Limiters (BCLs) control the battery coupling and uncoupling to the DC BATTERY BUS to ensure battery charging and protection. Each battery is rated at 24 V with a capacity of 23 Ah. All TRs are identical and interchangeable.
In the Electrical Power Generation System (EPGS), the GAPCU controls the APU GEN and the external power. The Generator Control Units (GCUs) protect and control the A/C network and generators and display the AC electrical power parameters on ECAM. The main C/B panels are located in the cockpit.
The ESS TR is identical to TR 1 and TR 2. It converts 115 VAC to 28 VDC at a rate of 200 A. The EMER GCU connects the EMER GEN to the ESS network, if all conditions are met.
The Ground Power Control Panel and the external power receptacle are installed in front of the nose landing gear. On this panel, 2 Lights indicate the Ground Power Unit availability (AVAIL light) and connection to the A/C network (NOT IN USE light). The Ground Power Unit should supply 400 Hz 3 phase 115 VAC rated at 90 kVA minimum.
The MAINTenance BUS SW, located on the forward cabin Circuit Breaker (C/B) panel, lets the AC and DC service buses be supplied without energizing the whole A/C electrical network.
The aft cabin C/B panel contains only C/Bs.

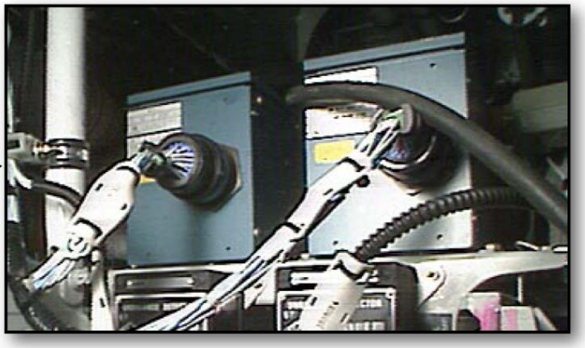


	VOLTAGE	FREQUENCY	PHASES	POWER
IDG 1/2	115 VAC	400 Hz	3 phases	90 kVA
APU GEN	115 VAC	400 Hz	3 phases	90 kVA
EMER GEN	115 VAC	400 Hz	3 phases	5 kVA

COMPONENT LOCATION

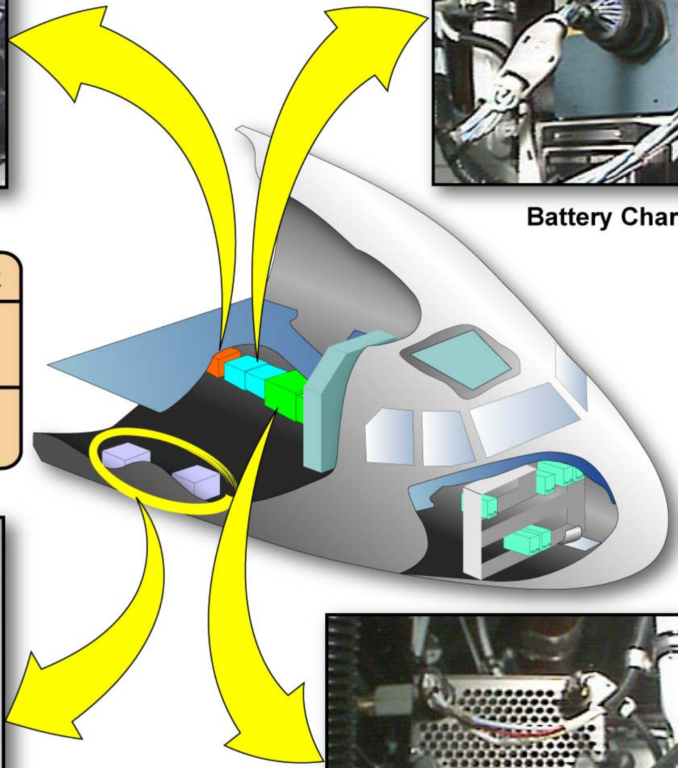
U7Z08431 - U0OT4T0 - UM24PZ000000002

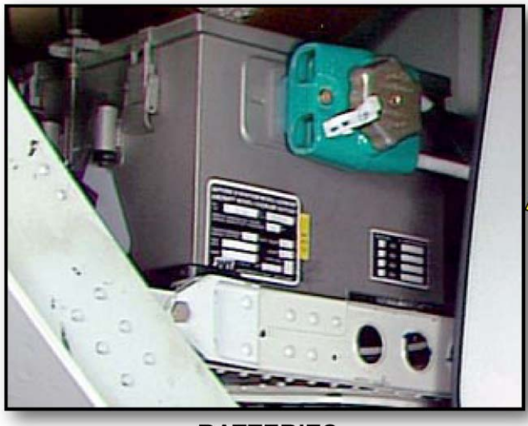
STATIC INVERTER



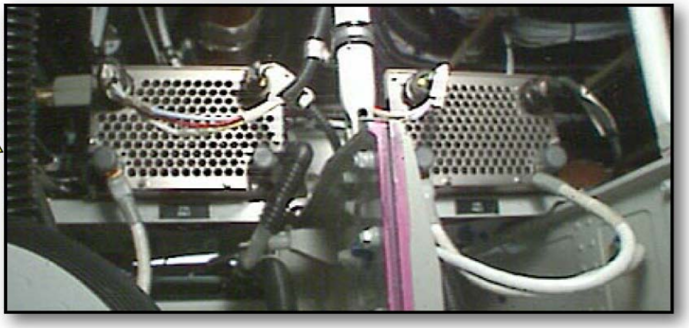
Battery Charge Limiters (BCLs)

	INPUT	OUTPUT	POWER
Static Inverter	24 VDC	115 VAC-400HZ (1 phase)	1 kVA
Transformer/ Rectifier (TR)	115 VAC	28 VDC	200 A





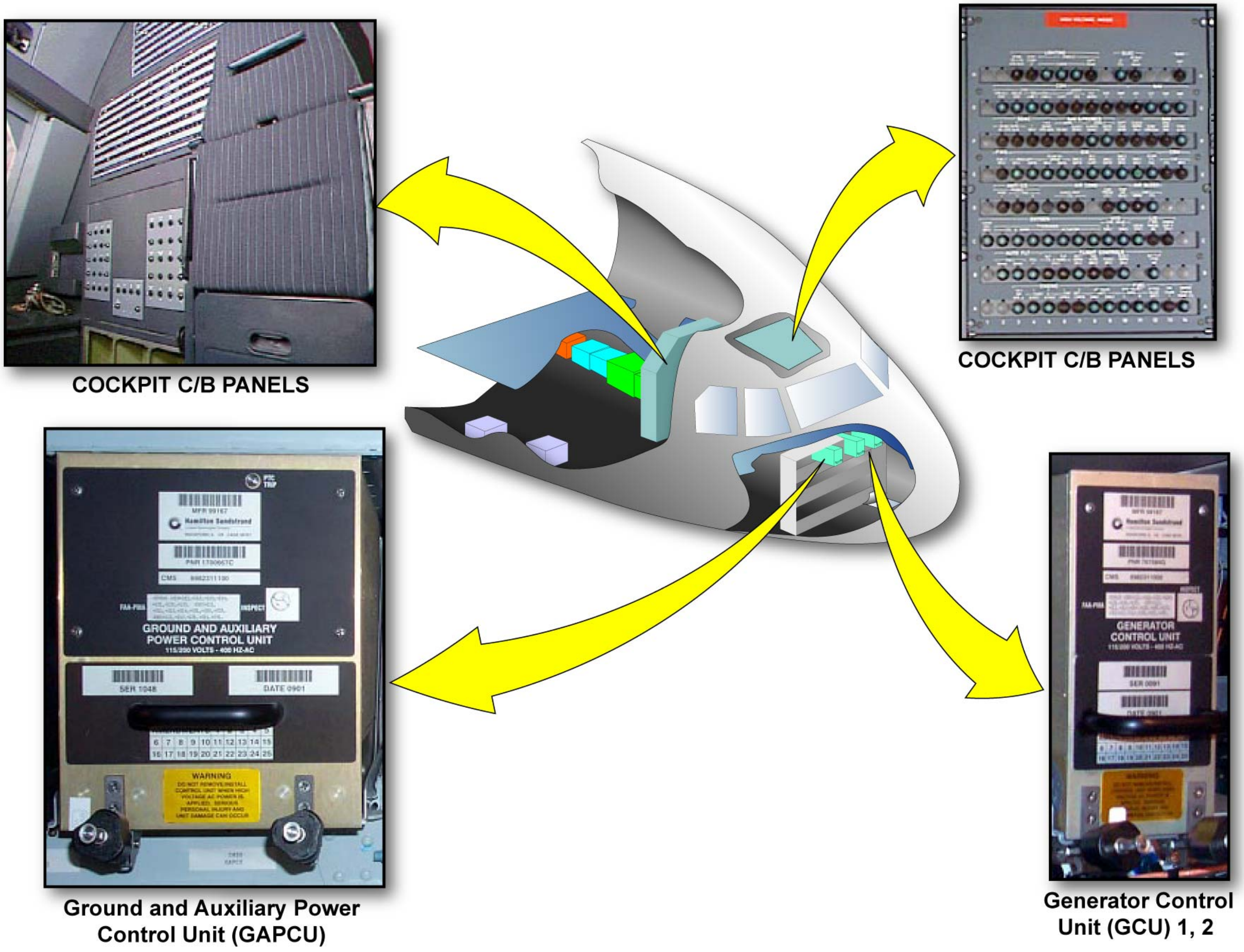
BATTERIES



Transformer Rectifier (TR) 1, 2

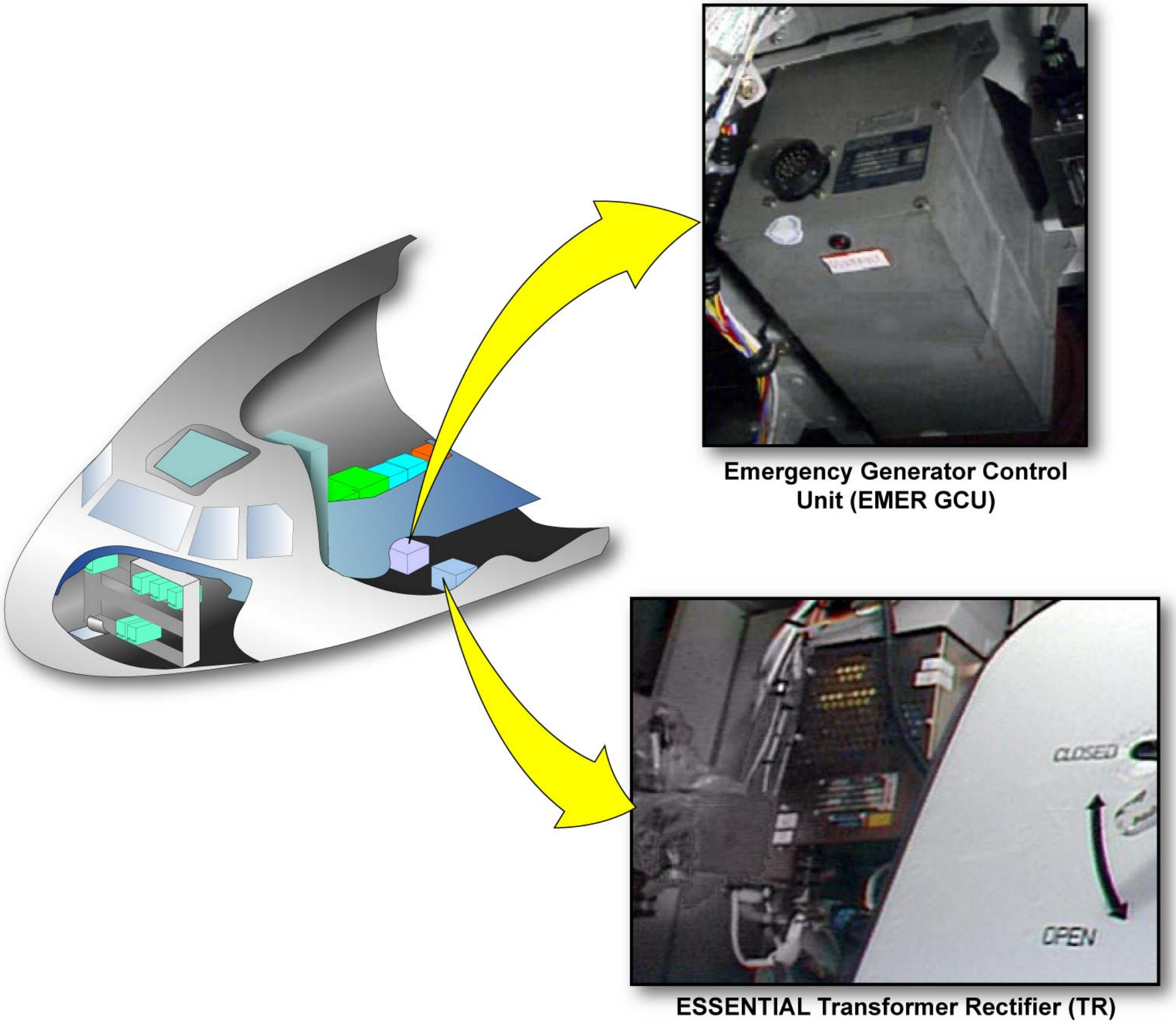
COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM24PZ000000002



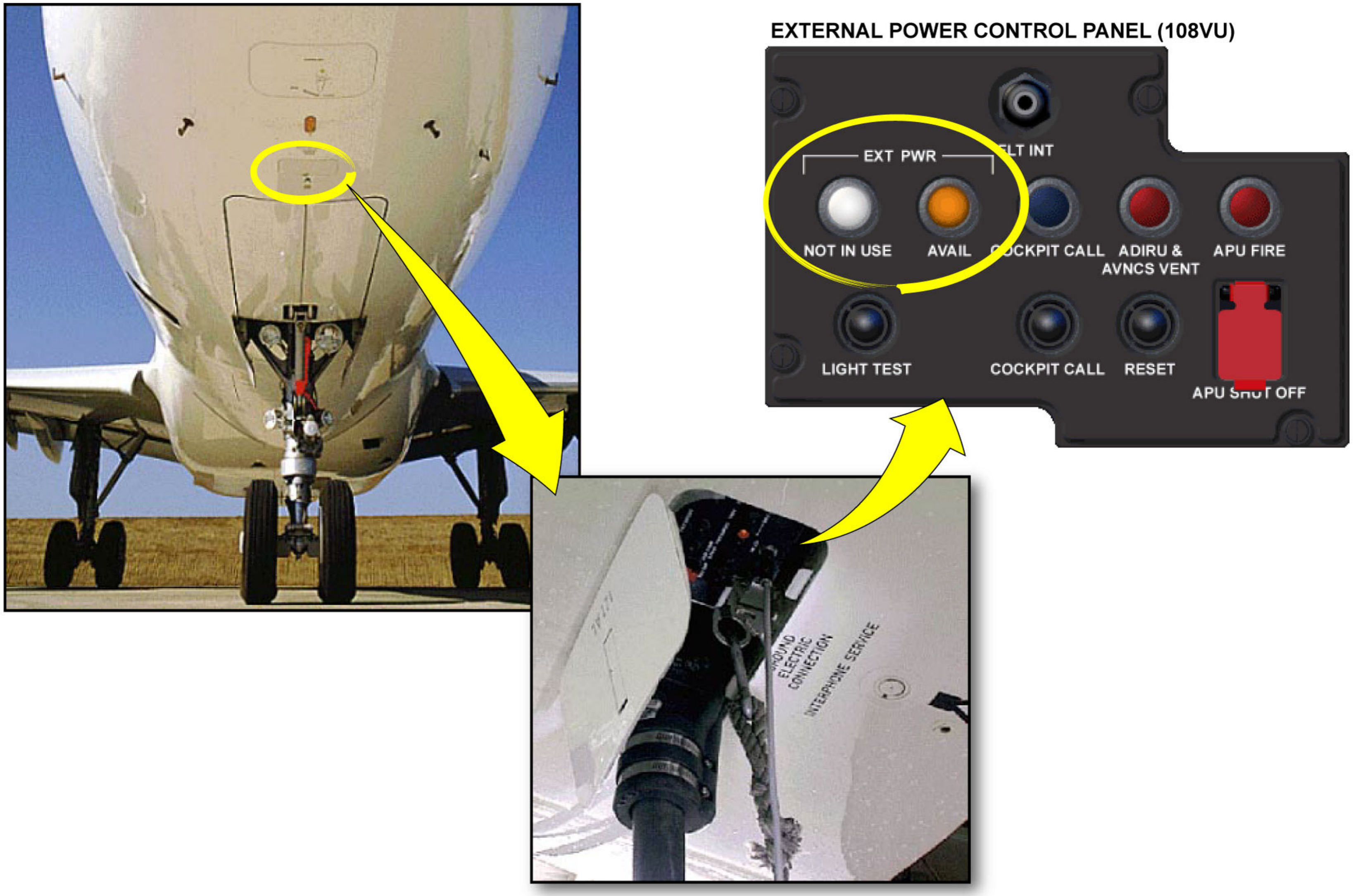
COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM24PZ000000002



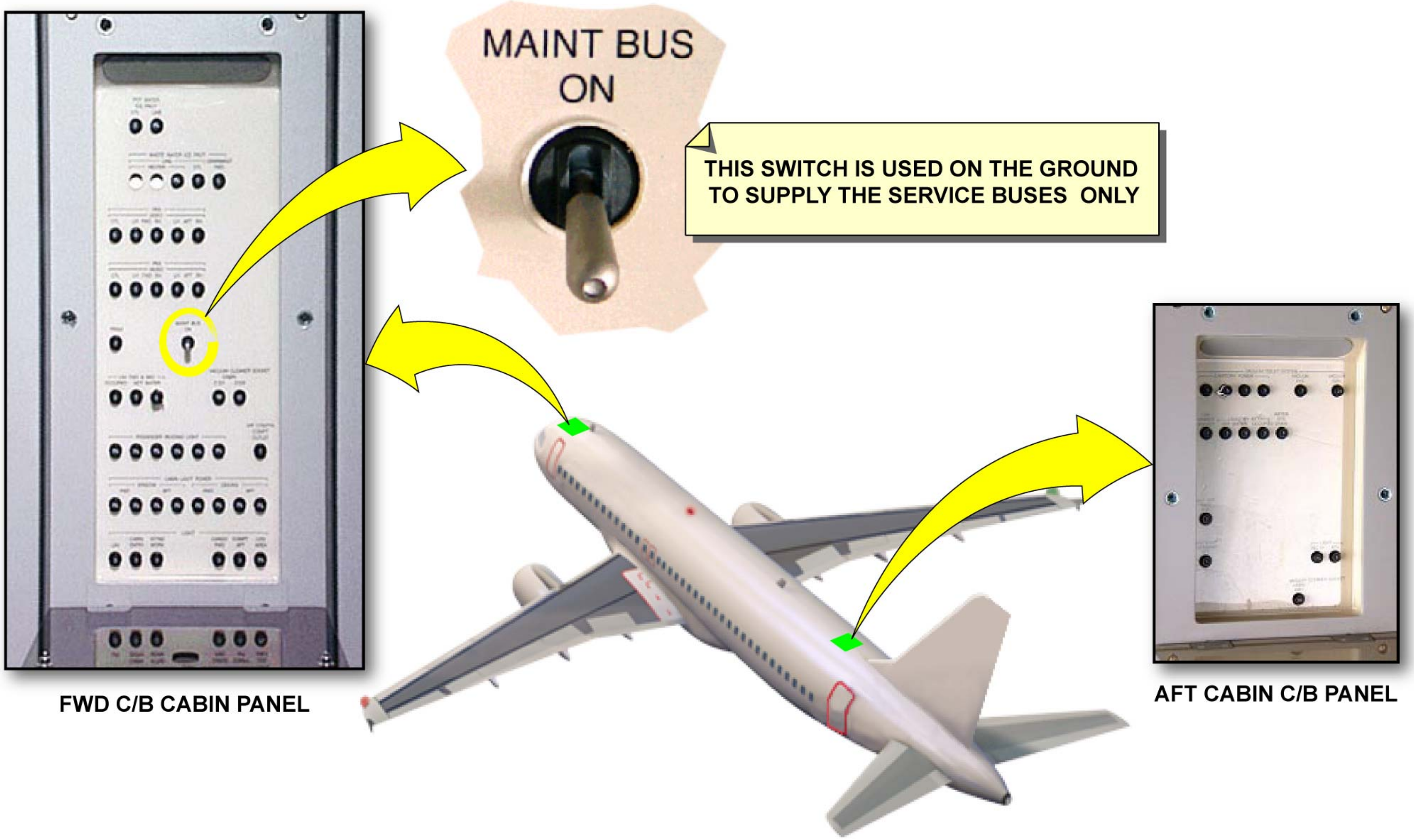
COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM24PZ000000002



COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM24PZ000000002



COMPONENT LOCATION

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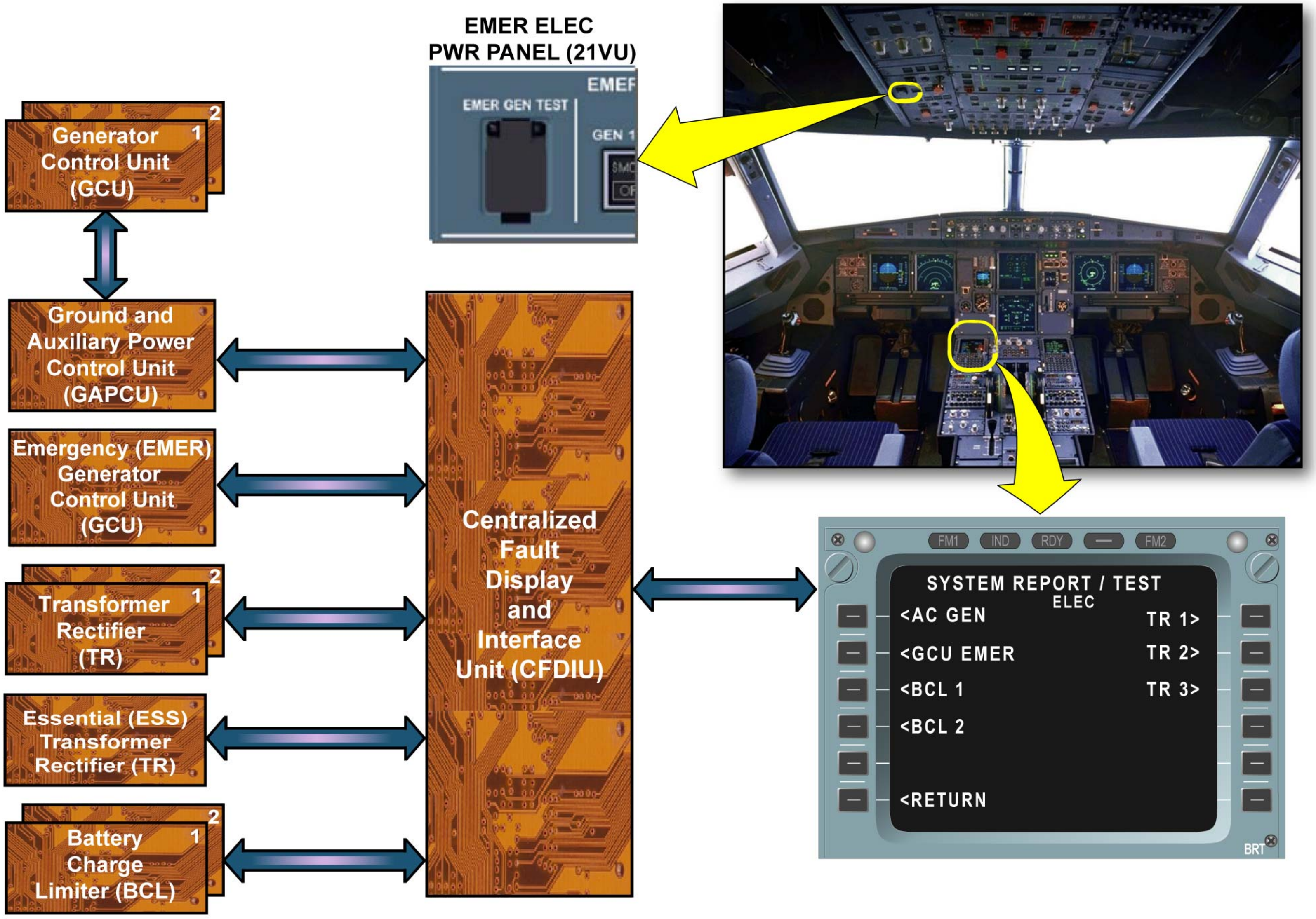
24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The GAPCU is the interface between the GCUs and the Centralized Fault Display Interface Unit (CFDIU) for test purposes and fault reporting on the MCDUs. Both the BCLs and the EMER GCU communicate with the CFDIU for the same purposes. The TRs are connected to the CFDIU so that they can be reset via the MCDU.



MAINTENANCE/TEST FACILITIES

U7Z08431 - U0OT4T0 - UM24PZ000000002

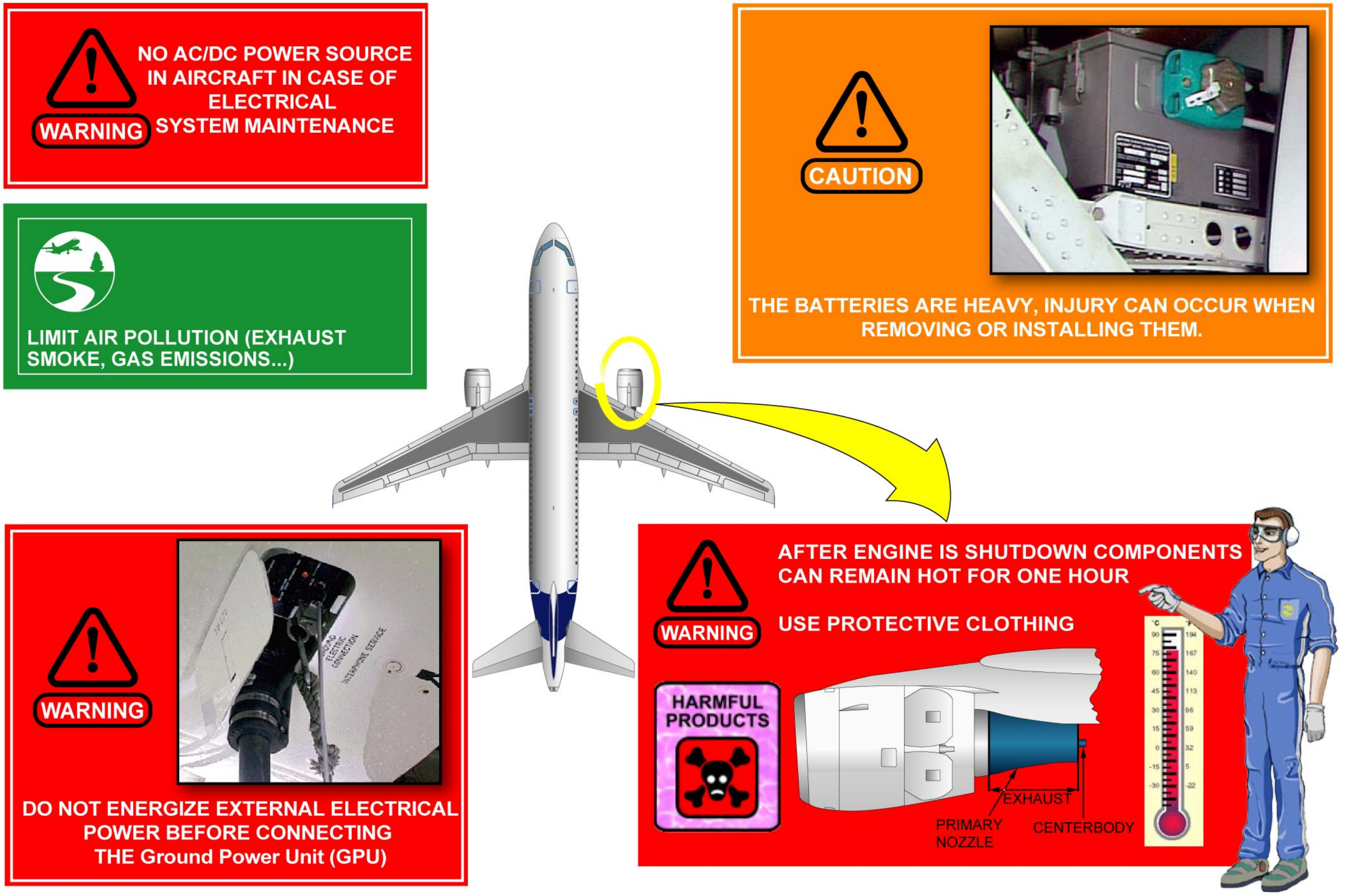
24 ELECTRICAL POWER SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you do any maintenance task on the electrical system, make sure that no AC or DC power source is connected to the aircraft electrical circuits.
Before De-energizing aircraft electrics or before doing the Static Inverter test, tell all personnel on the aircraft that the lights will go out.
Some components are heavy. You must make sure that you can hold the component before its removal/installation. If it falls, it can cause injury to personnel and damage to the equipment.
Dangerous arcing can occur if external power (GPU or Gate power) is energized when trying to connect power to the aircraft. Make sure that external power source is de-energized before connecting.
Components can remain hot for one hour following engine shutdown. Be careful as hot parts and hot oil can cause injury and burn your eyes and skin. Use protective clothing as oil products are poisonous.

ENVIRONMENTAL PRECAUTIONS

Turn-off unused ground service equipment (GPU, Air conditioning cart, etc...) if no work is being done or nobody is present on the aircraft.



SAFETY PRECAUTIONS - ENVIRONMENTAL PRECAUTIONS

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

GENERAL SYSTEM

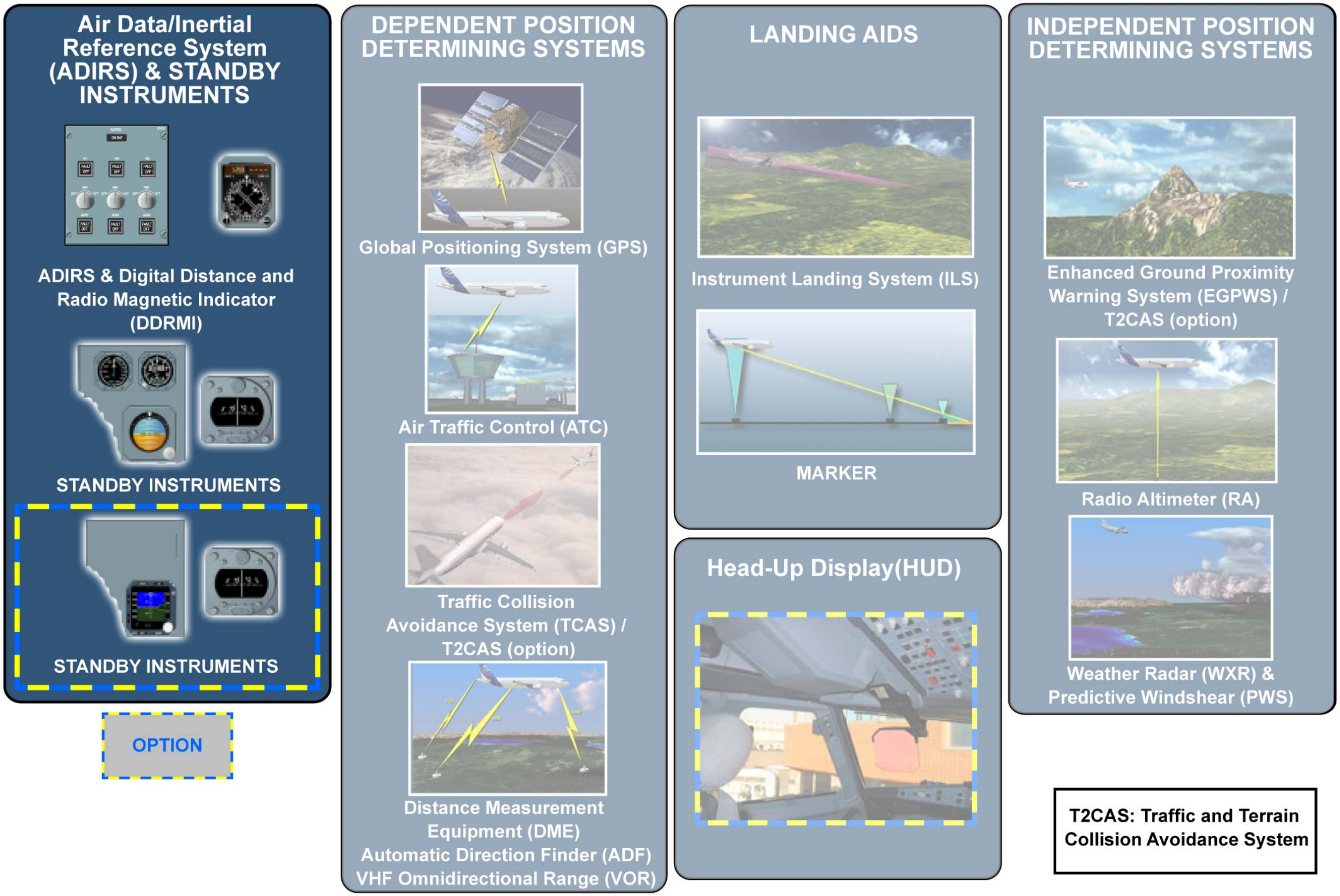
The Airbus Single Aisle aircraft family includes several different types of navigation systems, each used for particular functions. The systems will be explained in separate groups based on their functions. These functions are broken down into 4 main groups. They will be presented in separate modules:
- Air Data/Inertial Reference System (ADIRS) and standby instruments,
- dependent position determining systems,
- landing aids,
- independent position determining systems.

There are several subsystems within each group.
The first group includes:
- Air Data Inertial Reference Units (ADIRUs),
- Standby Instruments,
- Digital Distance and Radio Magnetic Indicator (DDRMI),
- Integrated Standby Instrument System (ISIS).

The second group (dependent position determining systems) includes:
- GPS,
- ATC/Traffic Alert and Collision Avoidance System (TCAS),
- DME,
- ADF,
- VOR.

The third group (landing aids) includes:
- ILS,
- marker receivers.

The fourth group (independent position determining systems) includes:
- Ground Proximity Warning System (GPWS),
- RAs,
- Weather Radar (WXR) and Predictive Windshear (PWS).



GENERAL SYSTEM

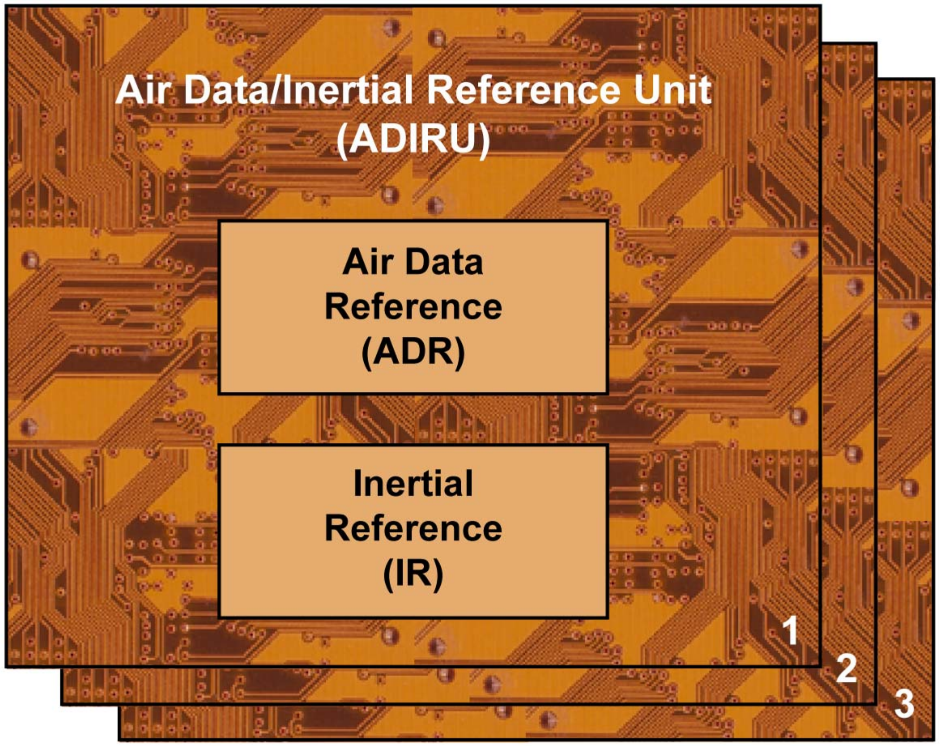
U7Z08431 - U0OT4T0 - UM34PZ000000002

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM

The aircraft has three identical and interchangeable ADIRUs.
Each ADIRU combines computers that carry out two functions in a single unit with a shared power supply. Those computers are:
- an Air Data Reference (ADR) unit,
- a strapdown Inertial Reference (IR) unit, using laser gyros and accelerometers.

The ADR and IR systems of each ADIRU operate independently, and failure of one system does not affect the other one.



AIR DATA/INERTIAL REFERENCE SYSTEM

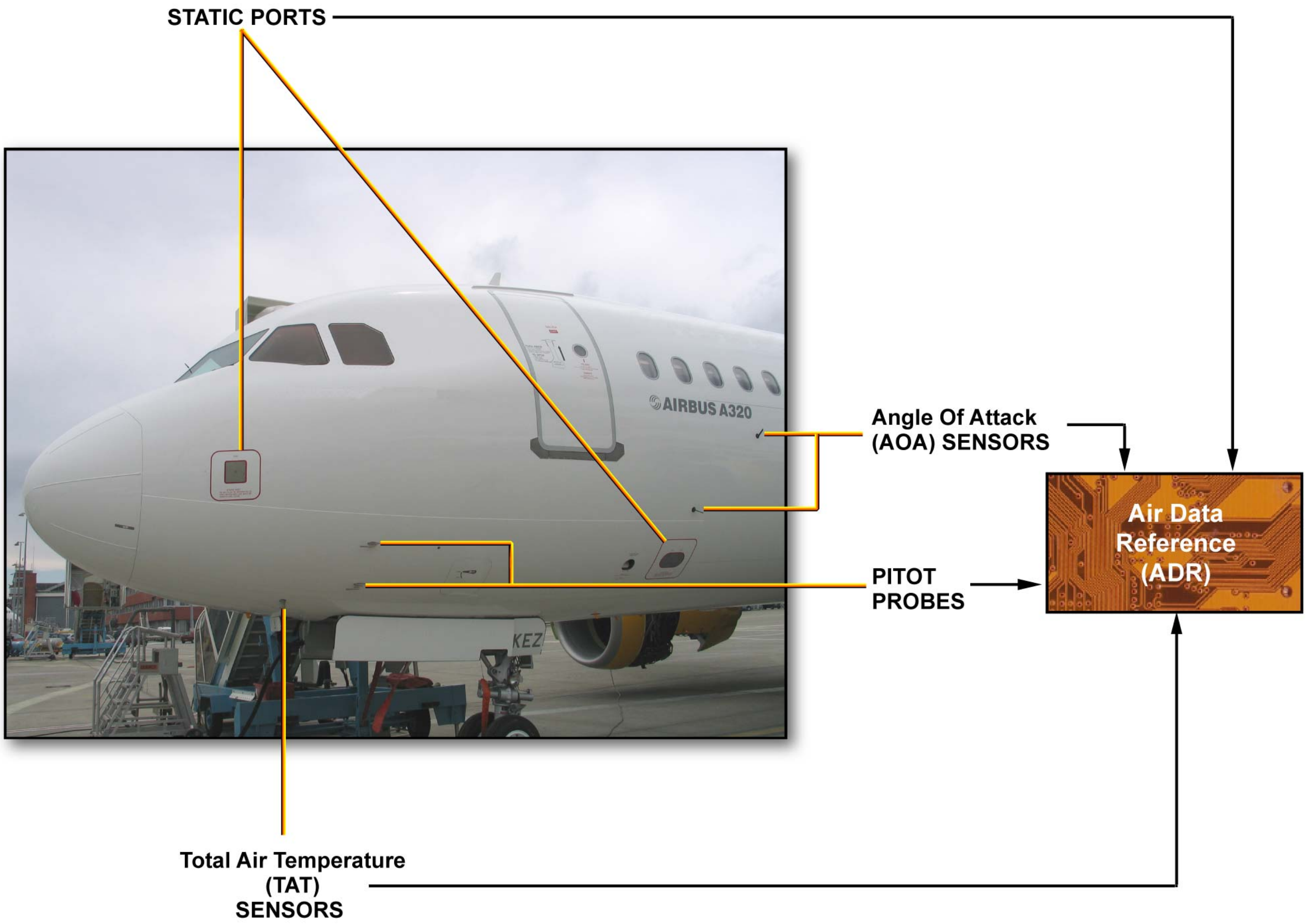
34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM (continued)

AIR DATA INPUTS

The ADIRS systems have peripheral components connected to the LRUs. These components are an integral part of the Air Data portion. The components are:

- pitot probes,
- static ports,
- Angle of Attack Sensors (AOA),
- Total Air Temperature Sensor (TAT).



AIR DATA/INERTIAL REFERENCE SYSTEM - AIR DATA INPUTS

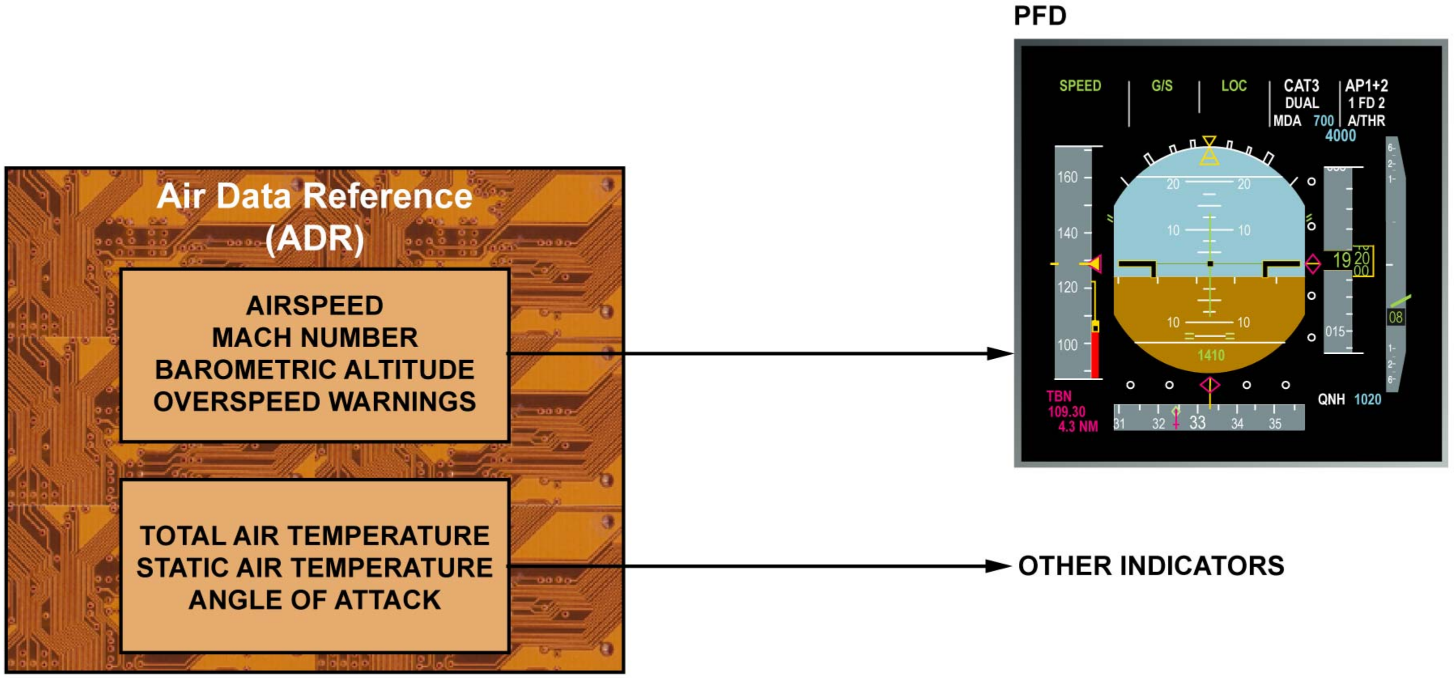
U7Z08431 - U0OT4T0 - UM34PZ000000002

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM (continued)

AIR DATA SECTION

The ADR part supplies various air data parameters to the EFIS instruments and other users:
- airspeed, mach number, barometric altitude to the PFD and overspeed to the Flight Warning Computer (FWC),
- TAT, Static Air Temperature (SAT), and AOA sensors to other indicators and users.



AIR DATA/INERTIAL REFERENCE SYSTEM - AIR DATA SECTION

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM (continued)

INERTIAL REFERENCE SECTION

The IR part of the ADIRU uses laser gyros and accelerometers. They give inertial data to the EFIS, Flight Management and Guidance Computers (FMGCs) and other users. Each ADIRU provides:
- attitude, heading, Vertical Speed (V/S), flight path vector to the PFD,
- heading, ground speed to the ND,
- IR position to FMGCs for A/C position computation. This information is available on the MCDU DATA page.

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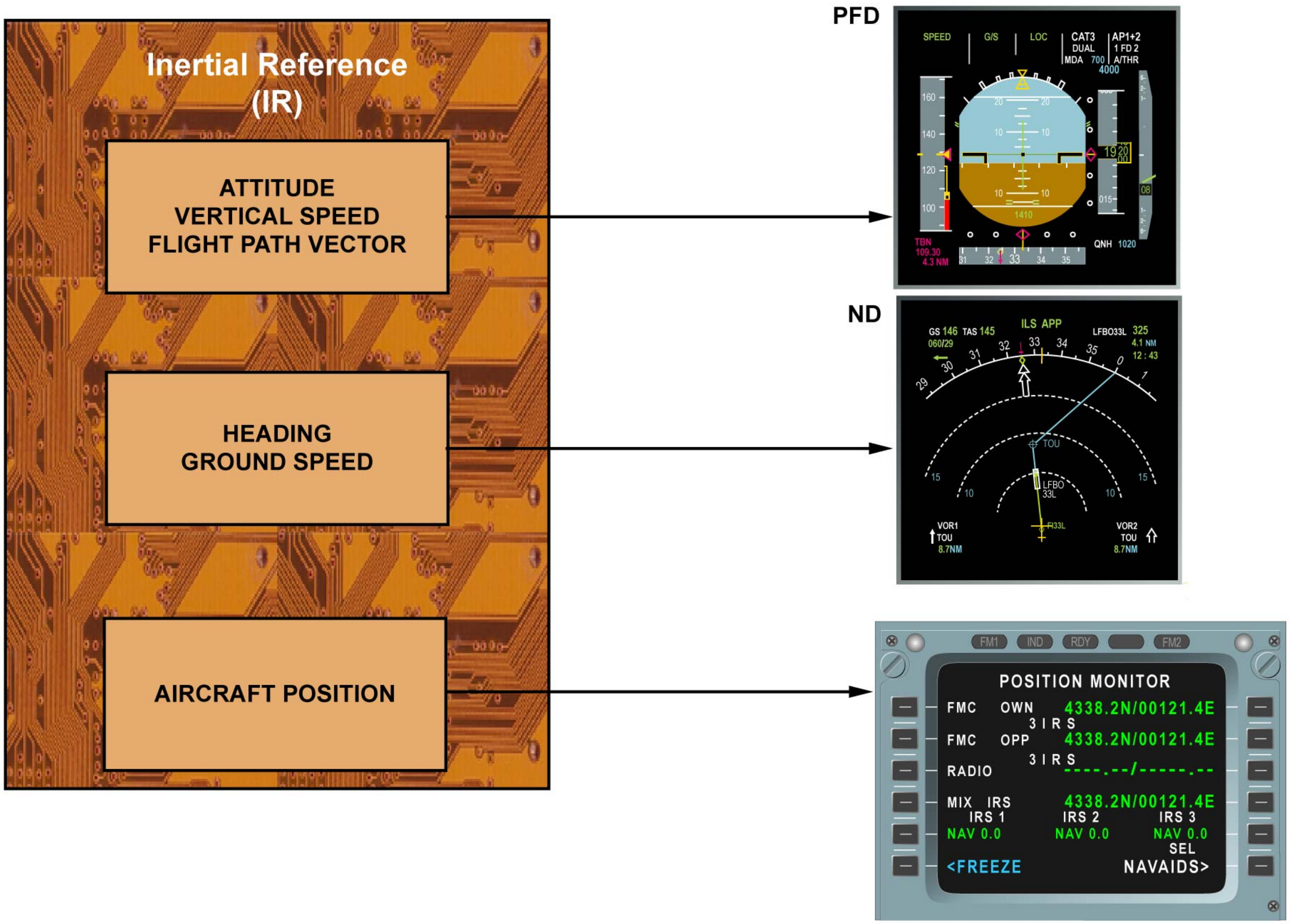


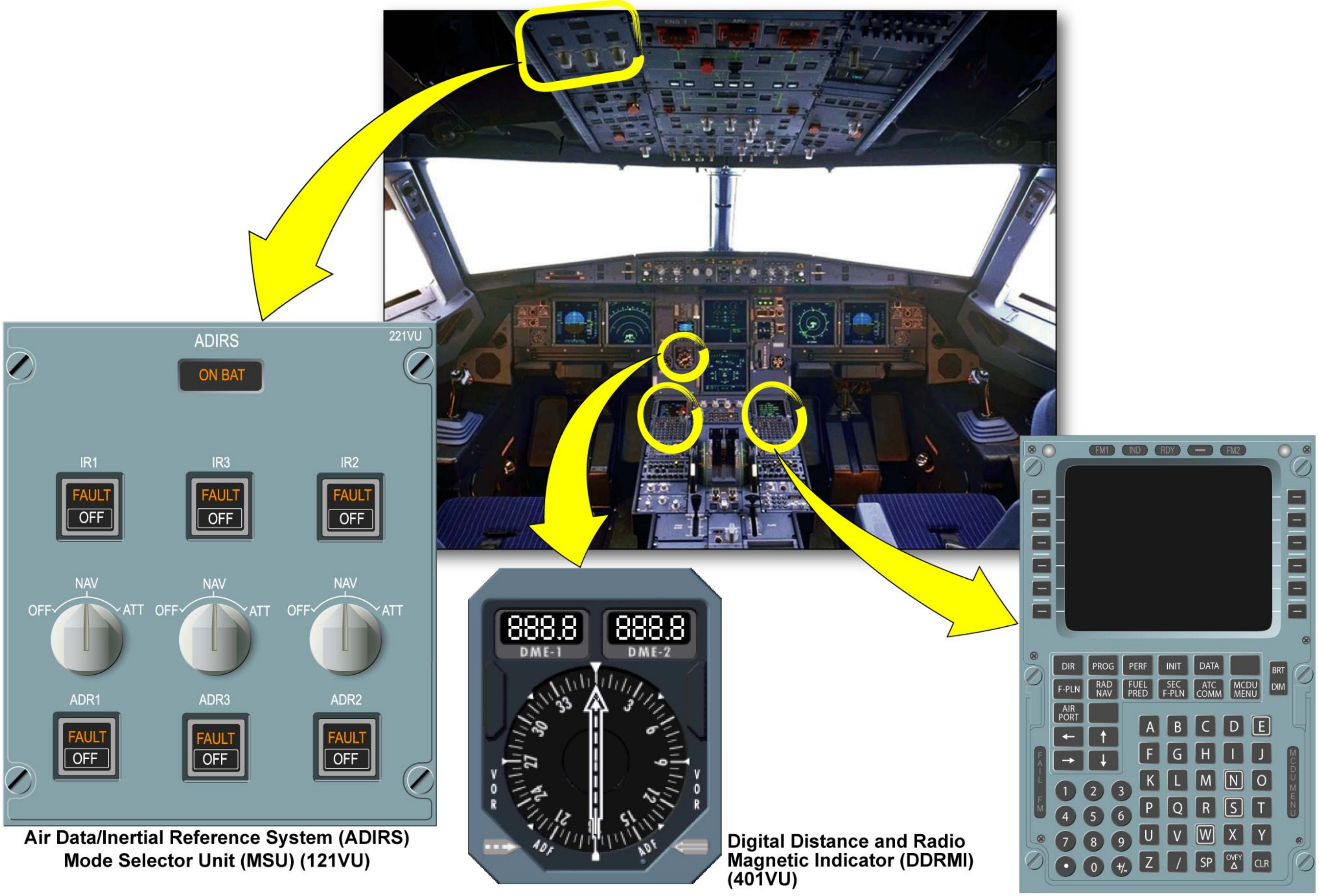
AIR DATA/INERTIAL REFERENCE SYSTEM - INERTIAL REFERENCE SECTION

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM (continued)

ADIRS CONTROL AND INDICATING

The three ADIRUs are controlled through the single ADIRS Mode Selector Unit (MSU) located on the overhead panel.
The initialization of the ADIRUs is normally done through either one of the two MCDUs installed on the center pedestal.
The Digital Distance Radio Magnetic Indicator (DDRMI) is installed on the main instrument panel below the standby instruments.
It supplies digital DME distance information, as well as heading coming from ADIRS, and VOR/ADF bearing information.



AIR DATA/INERTIAL REFERENCE SYSTEM - ADIRS CONTROL AND INDICATING

U7Z08431 - U0OT4T0 - UM34PZ000000002

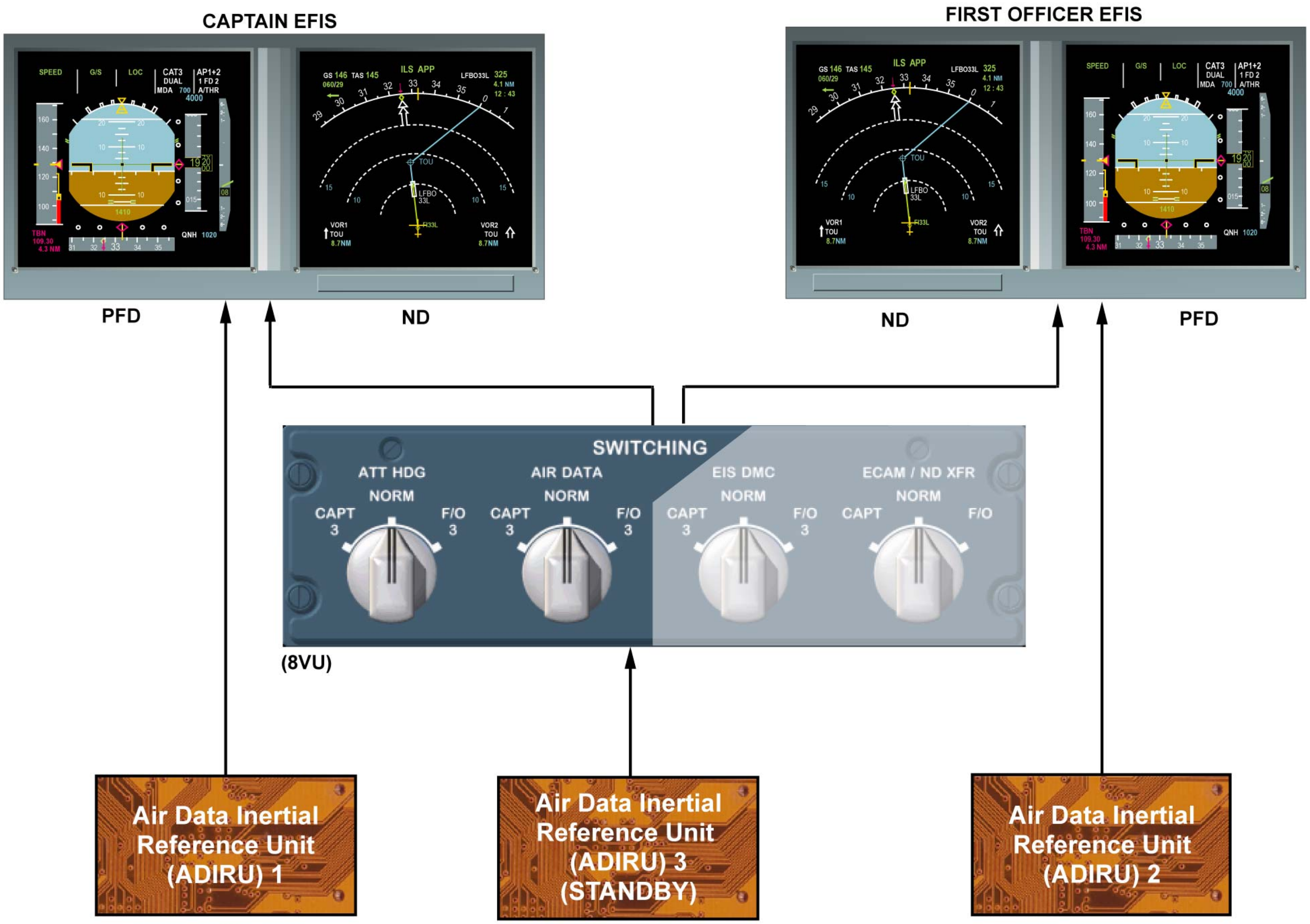
34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

AIR DATA/INERTIAL REFERENCE SYSTEM (continued)

PFD AND ND INDICATING

ADIRU 1 supplies the CAPT PFD and ND, and ADIRU 2 supplies the F/O PFD and ND.
ADIRU 3 is used as a hot spare, and can be switched via the switching panel to replace either ADIRU 1 or ADIRU 2.

U7Z08431 - U0OT4T0 - UM34PZ000000002



AIR DATA/INERTIAL REFERENCE SYSTEM - PFD AND ND INDICATING

U7Z08431 - U0OT4T0 - UM34PZ000000002

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

STANDBY INSTRUMENTS

In case of EFIS system failures, the standby instruments can be used.
There are 3 conventional standby instruments, installed on the instrument panel:
- airspeed indicator,
- altimeter,
- horizon.

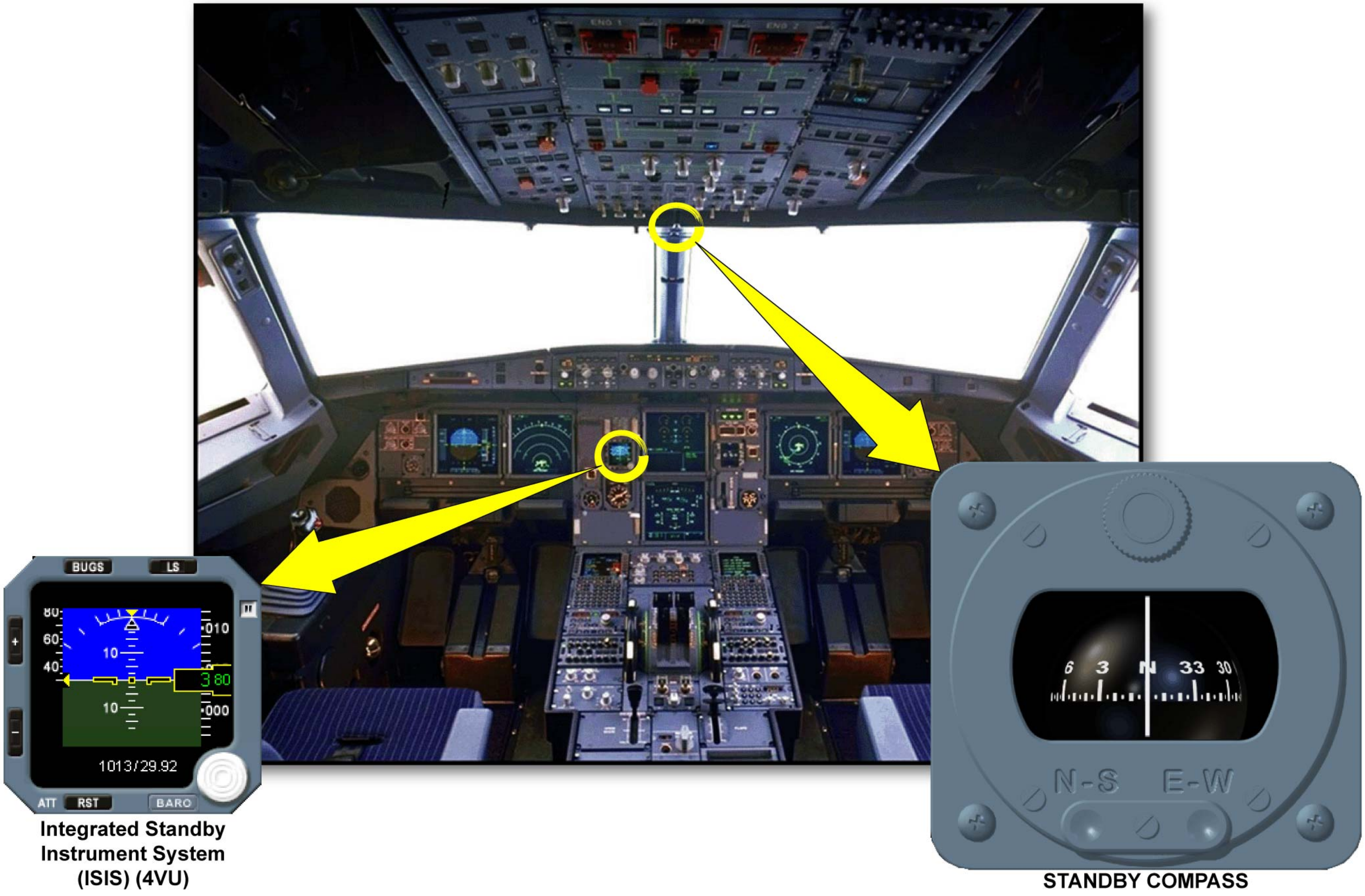
The standby compass is installed just below the overhead panel.

STANDBY INSTRUMENTS

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

INTEGRATED STANDBY INSTRUMENT SYSTEM (Option)

The enhanced standby instrument, called ISIS (Integrated Standby Instrument System), is installed on the instrument panel near the ECAM. It replaces the 3 conventional standby instruments. The inputs to the airspeed indication and the altimeter come directly from the air sources (standby pitot probe and static ports). The standby horizon is self-contained. ISIS is also capable of displaying heading and ILS information. The standby compass is installed just below the overhead panel.



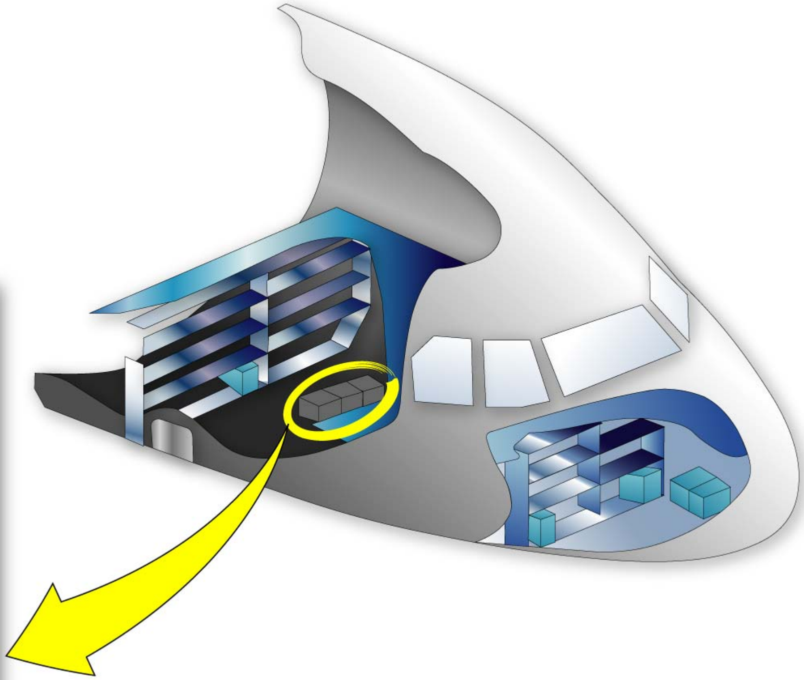
INTEGRATED STANDBY INSTRUMENT SYSTEM (OPTION)

U7Z08431 - U0OT4T0 - UM34PZ000000002

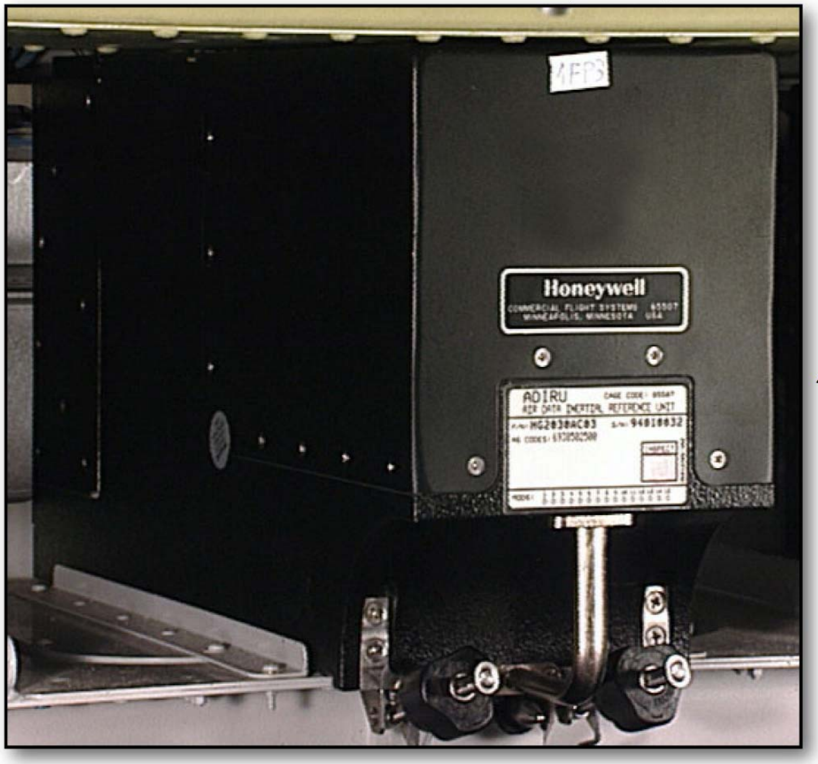
34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

COMPONENT LOCATION

Here is the location of the 3 ADIRUs.



Air Data Inertial Reference Unit (ADIRU)



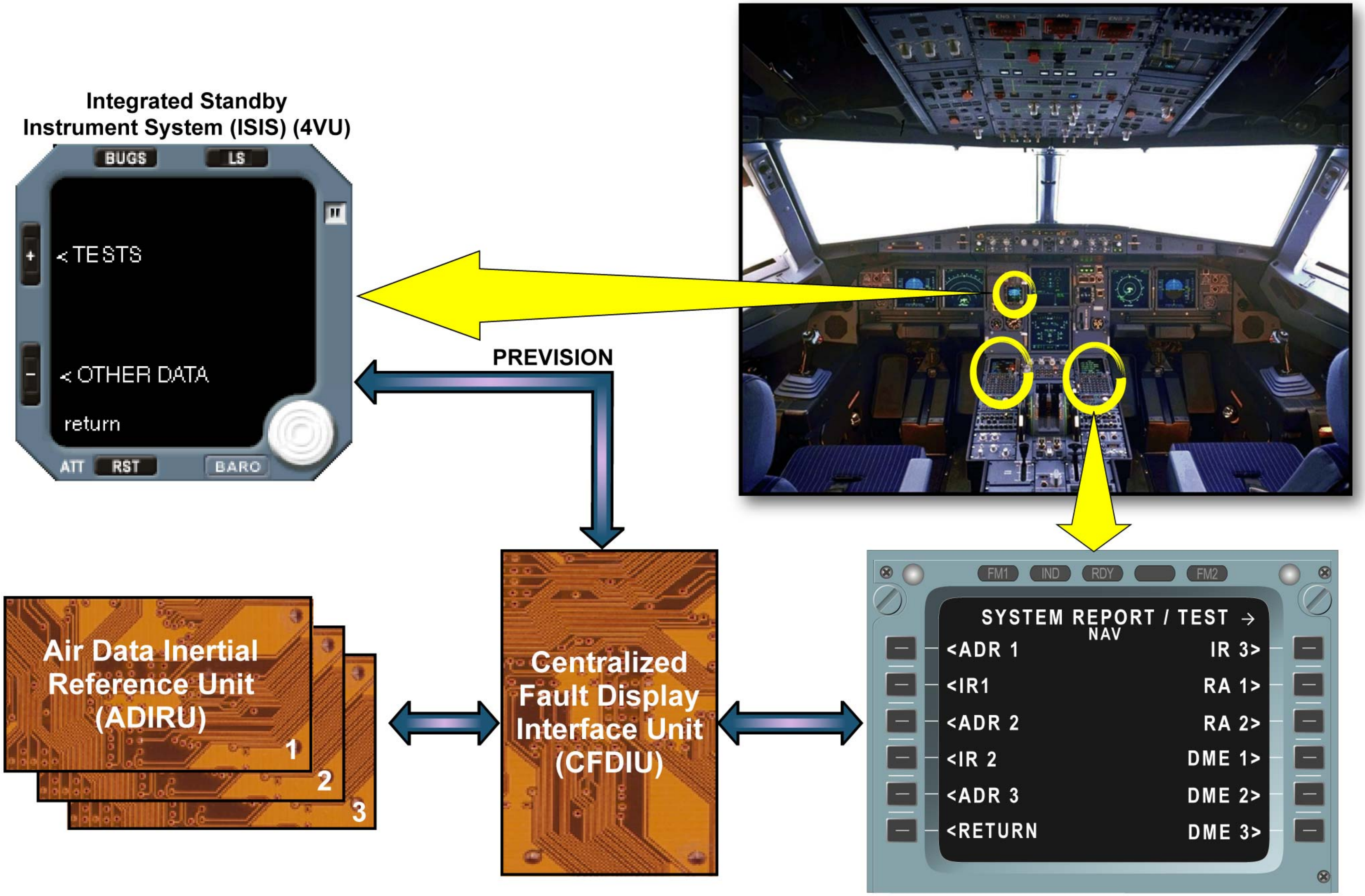
U7Z08431 - U0OT4T0 - UM34PZ000000002

COMPONENT LOCATION

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

All the navigation systems can be tested from the MCDUs except the ISIS.
ISIS tests and OTHER DATA are accomplished directly from the unit itself.

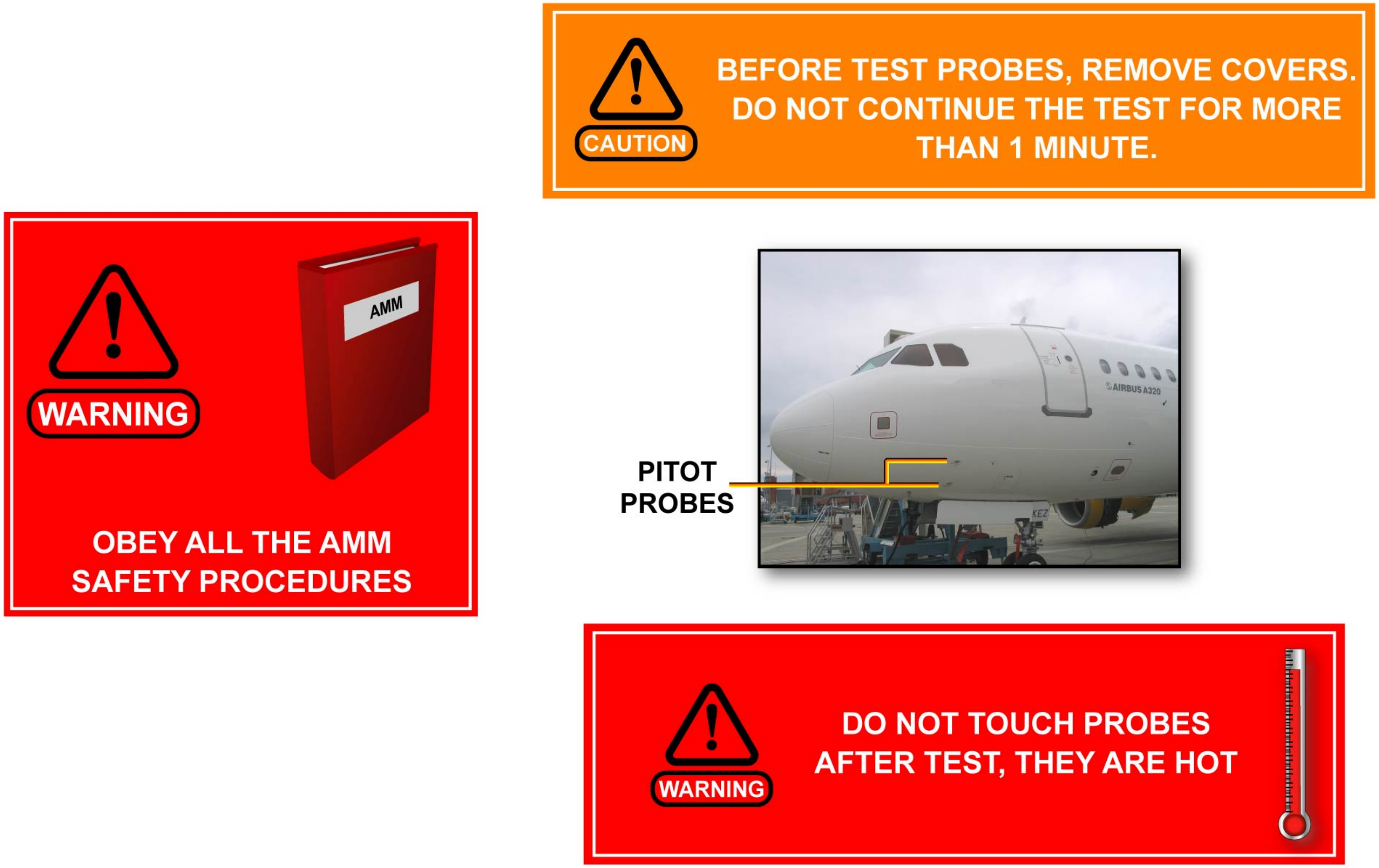


MAINTENANCE/TEST FACILITIES

34 ADIRS AND STBY INSTRUMENTS PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on A/C, make sure that you obey all the Aircraft Maintenance Manual (AMM) procedures. This will prevent injury to persons and/or damage to the A/C.
Before you do the test of the probes, remove the protective covers. Do not continue the test for more than one minute to prevent damage.
Do not touch the probes immediately after the test, they are hot.



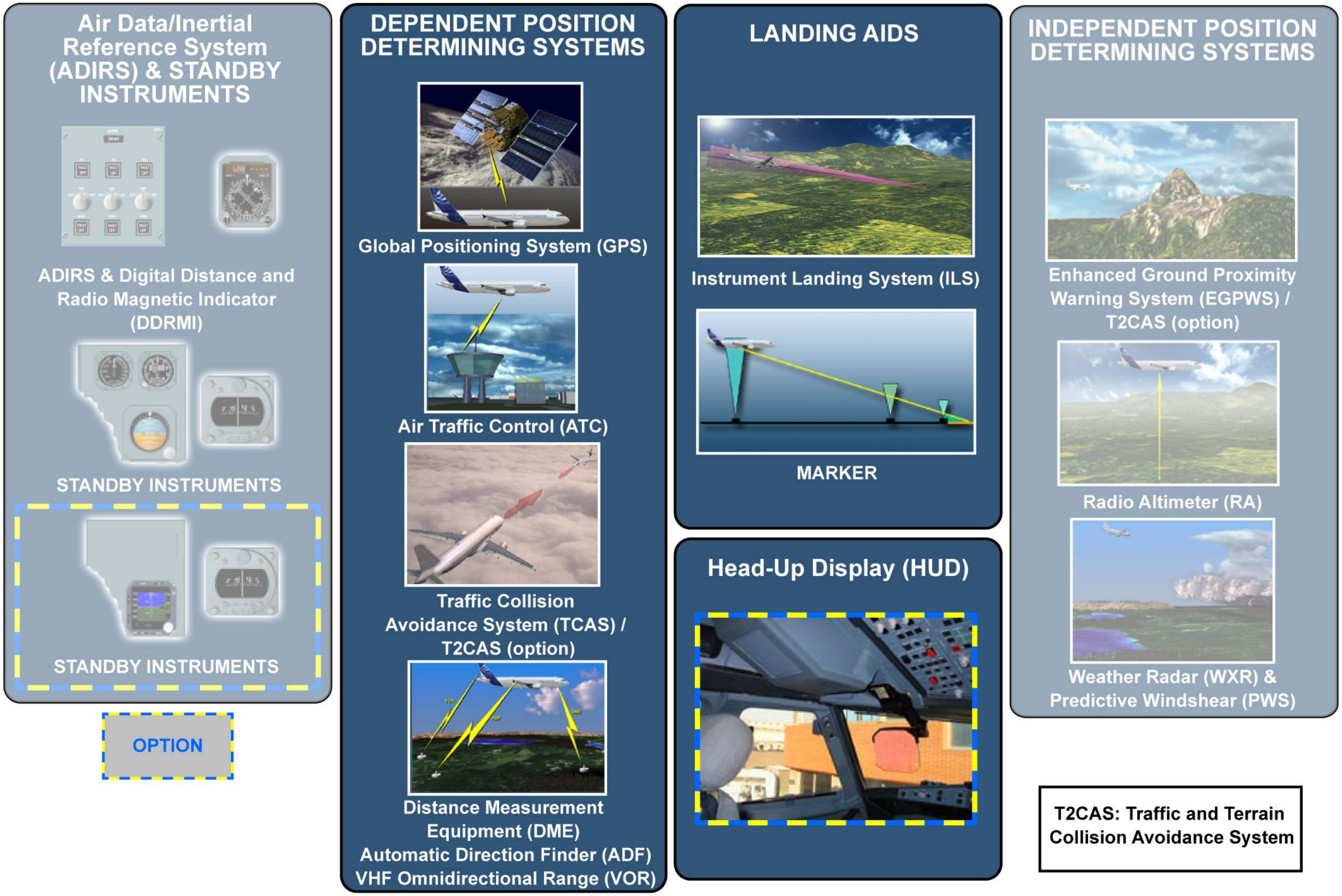
SAFETY PRECAUTIONS

U7Z08431 - U0OT4T0 - UM34PZ000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

LANDING AIDS

The navigation systems that require external inputs of the aircraft to operate are: the landing aids systems, the dependent position determining systems and the Head-Up Display (HUD) system. They include:
- ILS,
- marker system,
- GPS,
- ATC/Traffic Collision Avoidance System (TCAS)/Traffic and Terrain Collision Avoidance System (T2CAS) as option,
- DME,
- ADF,
- VOR.



LANDING AIDS

U7Z08431 - U0OT4T0 - UM34PY000000002

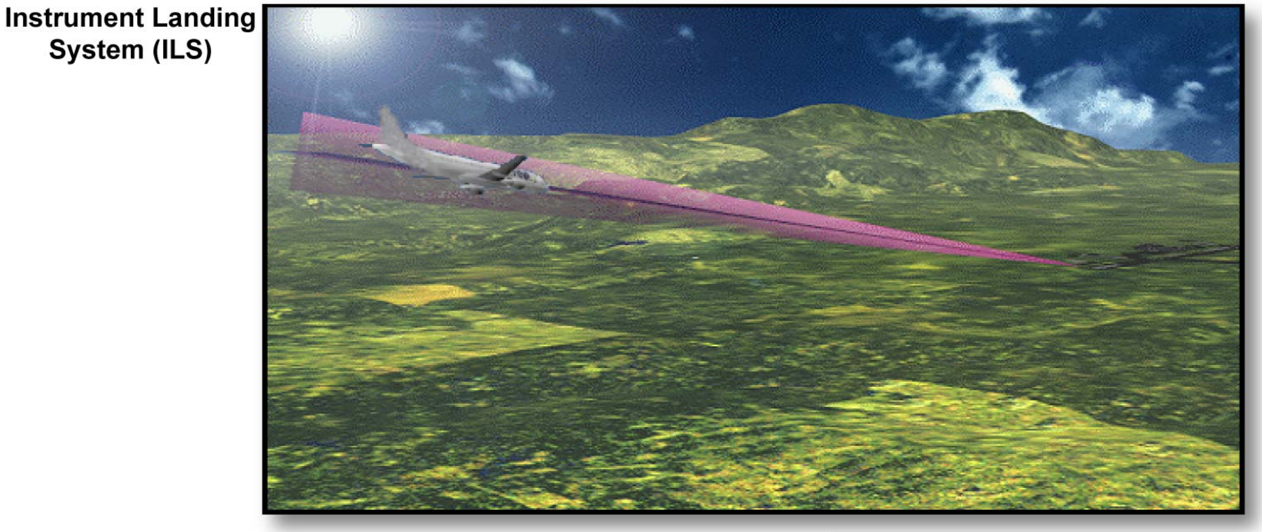
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

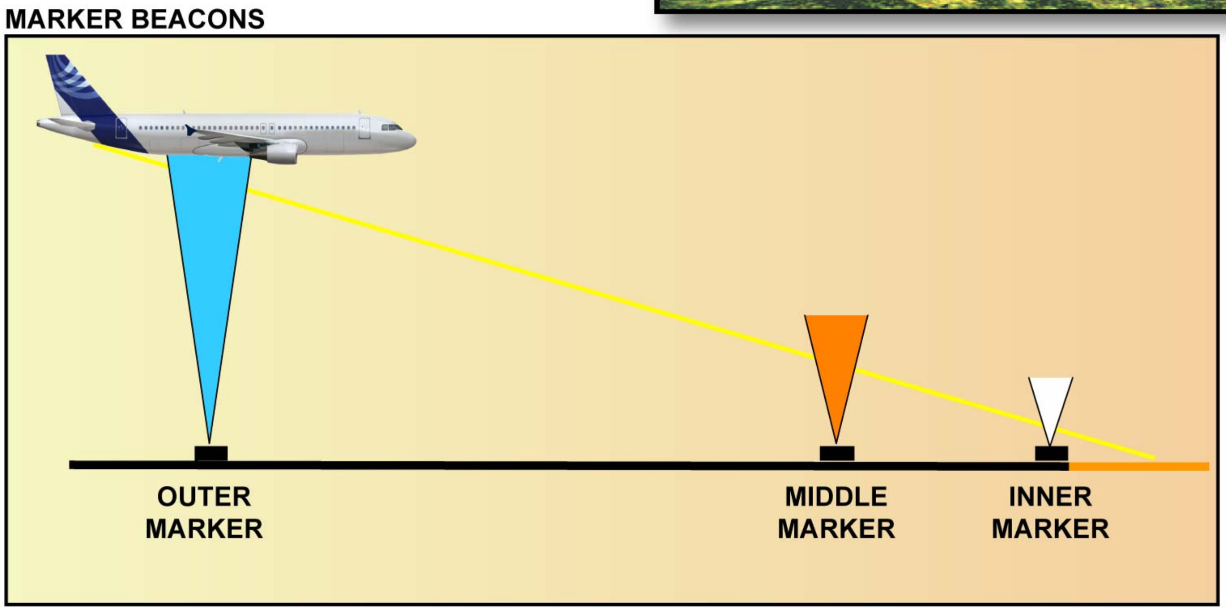
LANDING AIDS (continued)

ILS AND MARKER SYSTEM

The ILS sends to the flight crew or Autopilot (AP) signals for optimum descent path for landing. The ILS signal reception is done in part by the Multi-Mode Receiver (MMR). The system provides lateral guidance and vertical guidance to the aircraft approaching the runway.
The marker beacon system is a radio navigation aid that, in conjunction with an instrument landing system, indicates the distance between the A/C and the runway threshold. The marker function is done inside the VOR receivers, but it is only active in VOR 1. There are three types of marker beacons on an ILS:
- the outer marker,
- the middle marker,
- the inner marker.

When the aircraft goes over the beacons, the marker beacon information is displayed flashing on the PFDs, with related audio signals.





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LANDING AIDS - ILS AND MARKER SYSTEM

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

LANDING AIDS (continued)

LANDING AIDS CONTROL AND INDICATING

The ILS information is displayed on the PFDs as 2 scales. One horizontal scale for the localizer signal and one vertical scale for the Glide Slope (G/S) signal.
Note that for redundancy:
- ILS 1 is displayed on PFD 1 and ND 2,
- ILS 2 is displayed on PFD 2 and ND 1.

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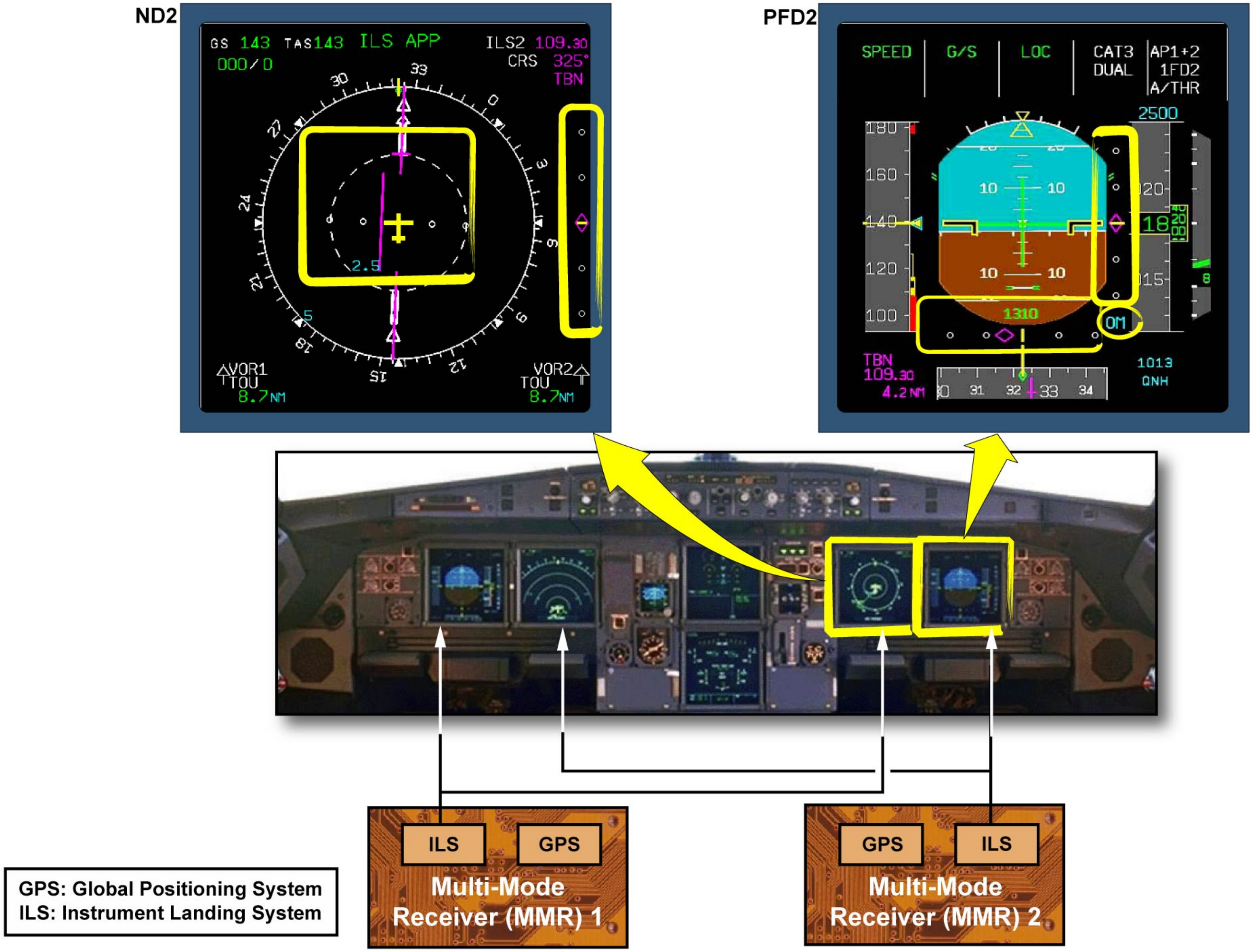


LANDING AIDS - LANDING AIDS CONTROL AND INDICATING

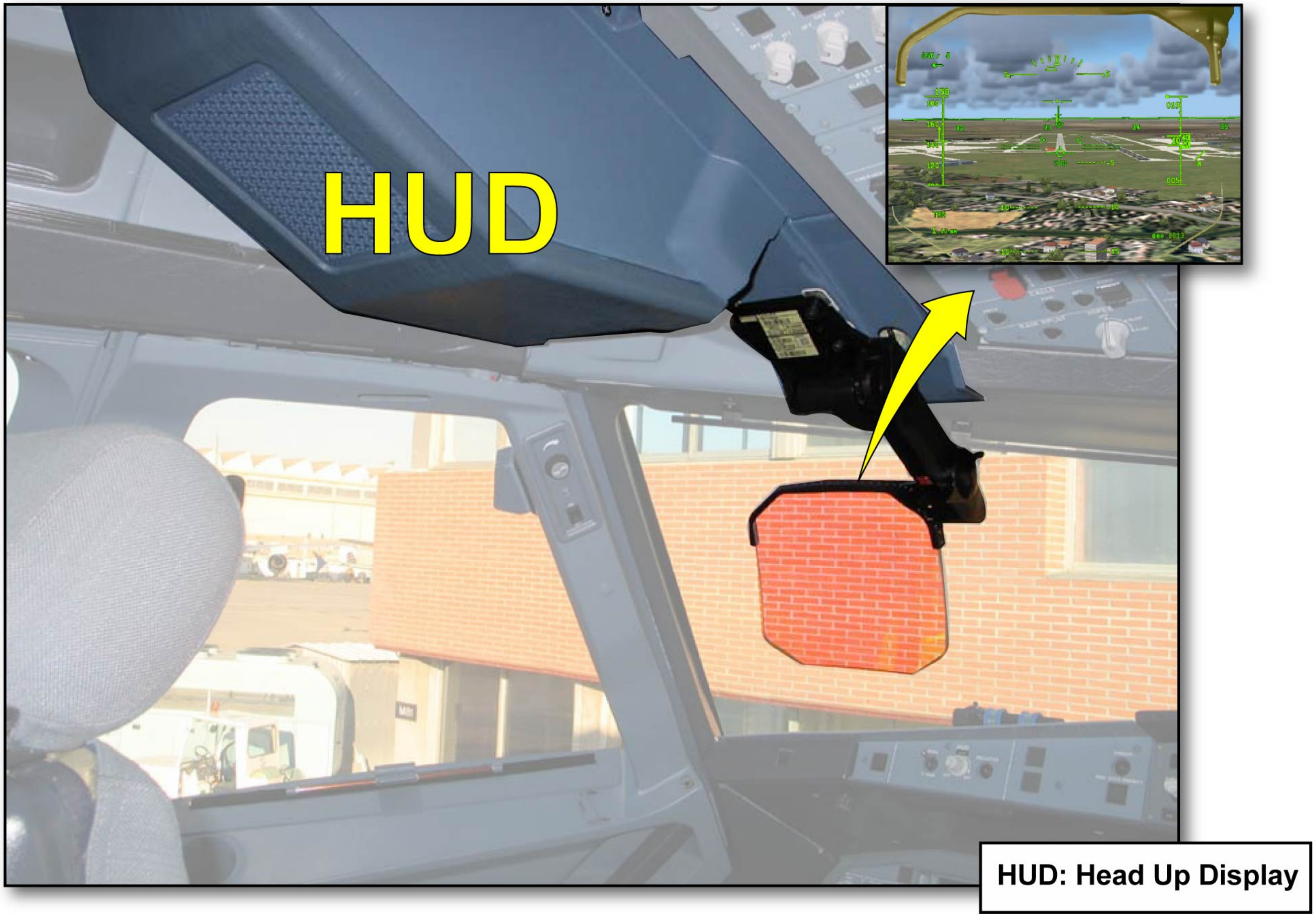
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

LANDING AIDS (continued)

HEAD-UP DISPLAY (OPTION)

The HUD is an optional flying aid system, which gives to the pilot an image superimposed on the outside world in his field of view. This aid is based on the principle of symbol projection on an external combiner, mainly composed of a flat sheet of glass.
The objectives of the HUD are :
- to supply guidance information on the ground, at take-off and landing in conditions of reduced visibility;
- to give information to the pilot for visual approach on airfields without Instrument Landing System (ILS);
- to monitor the automatic approach operations.



LANDING AIDS - HEAD-UP DISPLAY (OPTION)

U7Z08431 - U0OT4T0 - UM34PY000000002

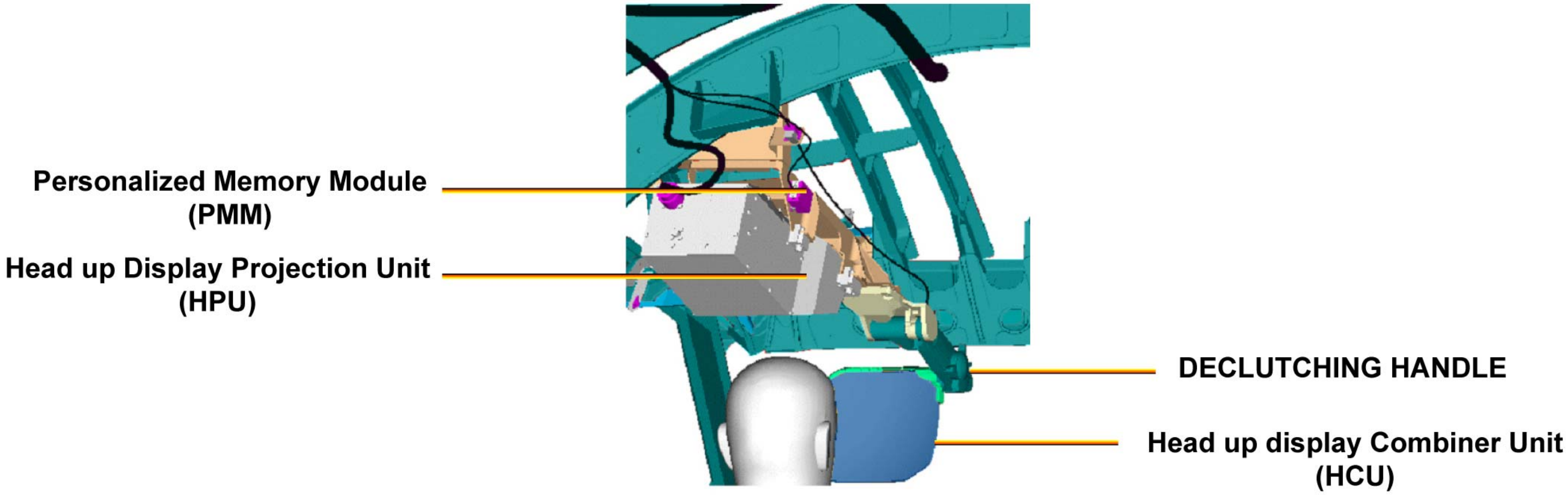
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

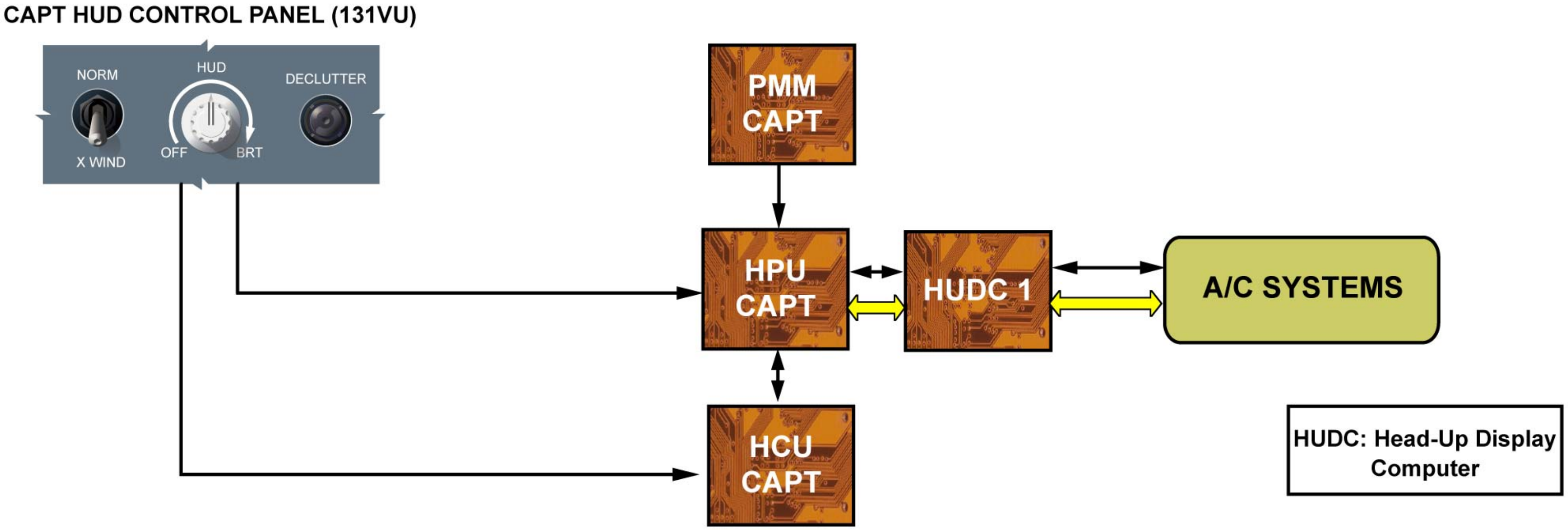
LANDING AIDS (continued)

HEAD-UP DISPLAY CONTROL

The HUD system is composed of one HUD set (giving head up data for the CAPT).
The HUD is composed of one Head-Up Computer (HUDC), one Head-Up Projection Unit (HPU), one Head-Up Combiner Unit (HCU), one Personalization Memory Module (PMM) and one HUD Control Panel.
The HUDC is located in the avionics bay 82VU.
It is used:
- to centralize the source data from the aircraft systems,
- to send the necessary data to the HPU.

The HPU is located inside the cockpit above the Captain.
It is used to generate the image to project towards the HCU. The generated image is sent to the HCU by the HPU optical lenses.
The HCU is located inside the cockpit in front of the Captain forward field of view.
It is used to reflect the image projected by the HPU towards the pilot while the forward field of view remains visible through the combiner.
The HCU can take two positions (operational or retracted) by means of a declutching handle, located on its right (left) hand side.
The PMM is a memory module used to store the HPU installation adjustment (Contains data specific to the A/C particular installation, eg correction of error in X/Y positioning).
One HUD Control Panel on 131VU in the cockpit left hand side is composed of:
- A HUD potentiometer used to switch ON/OFF the HUD,
- A DECLUTTER pushbutton switch used to change the display,
- And an X WIND switch also used to change the display.





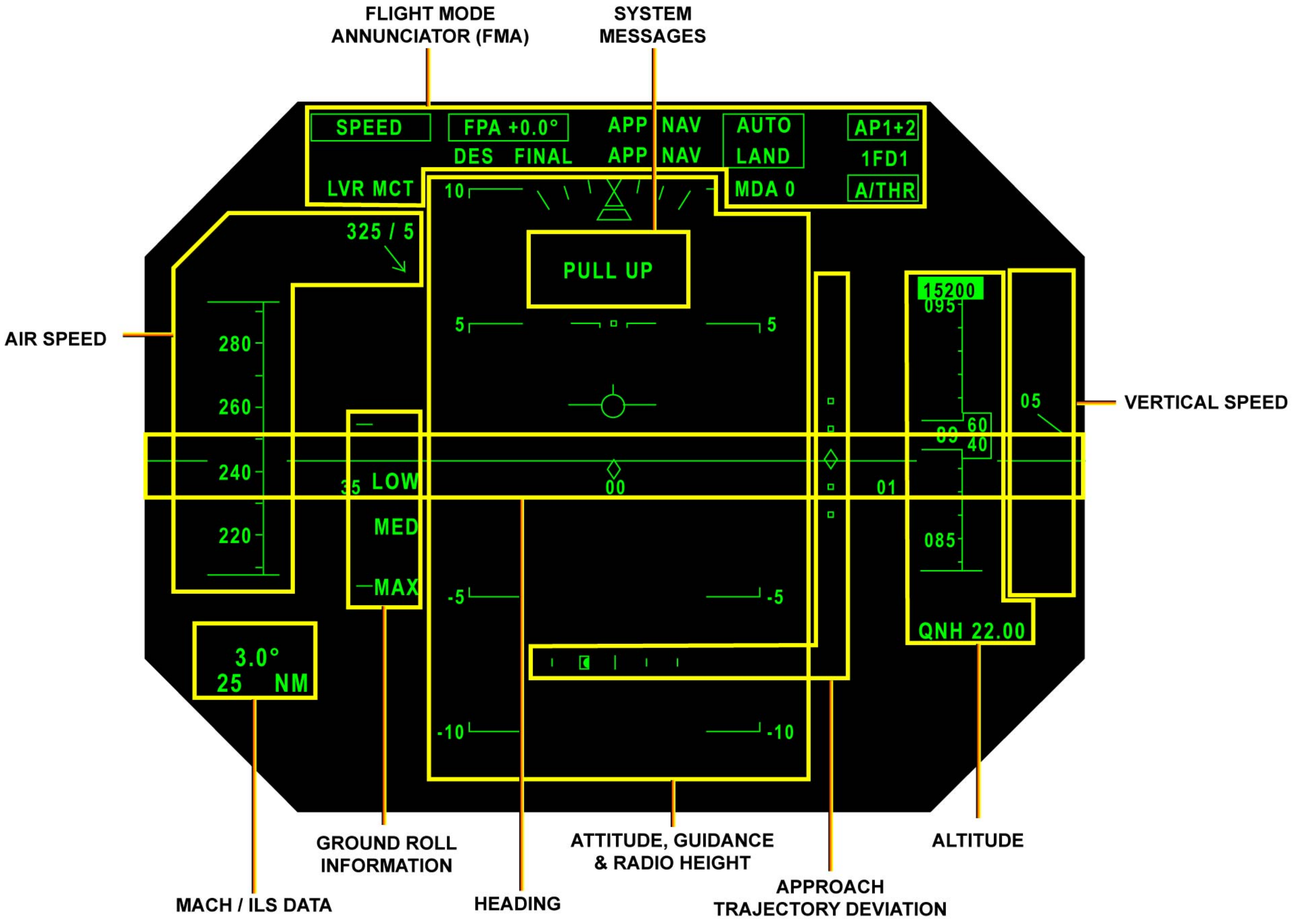
LANDING AIDS - HEAD-UP DISPLAY CONTROL

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

LANDING AIDS (continued)

HCU DISPLAY

According to the flight configuration, different displays can be shown to the pilot.
The HUD image is divided into ten areas, which show indications related to:
- attitude, guidance and radio height,
- heading,
- ground roll information,
- mach/ILS data,
- air speed,
- Flight Mode Annunciator (FMA),
- system messages,
- vertical speed,
- altitude,
- approach trajectory deviation.



LANDING AIDS - HCU DISPLAY

U7Z08431 - U0OT4T0 - UM34PY000000002

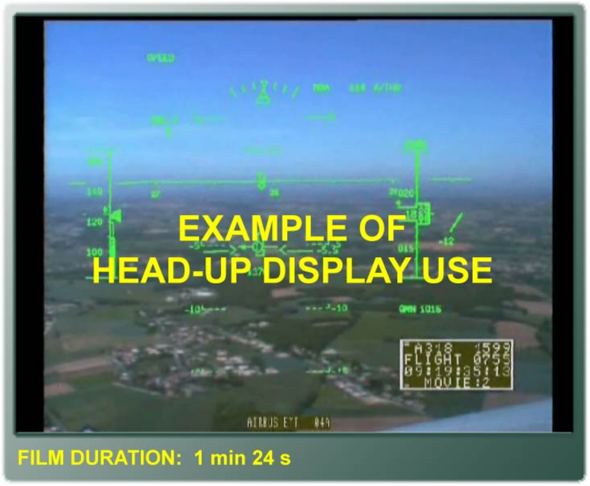
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

LANDING AIDS (continued)

EXAMPLE OF HUD USE

Film on HUD use

U7Z08431 - U0OT4T0 - UM34PY000000002



LANDING AIDS - EXAMPLE OF HUD USE

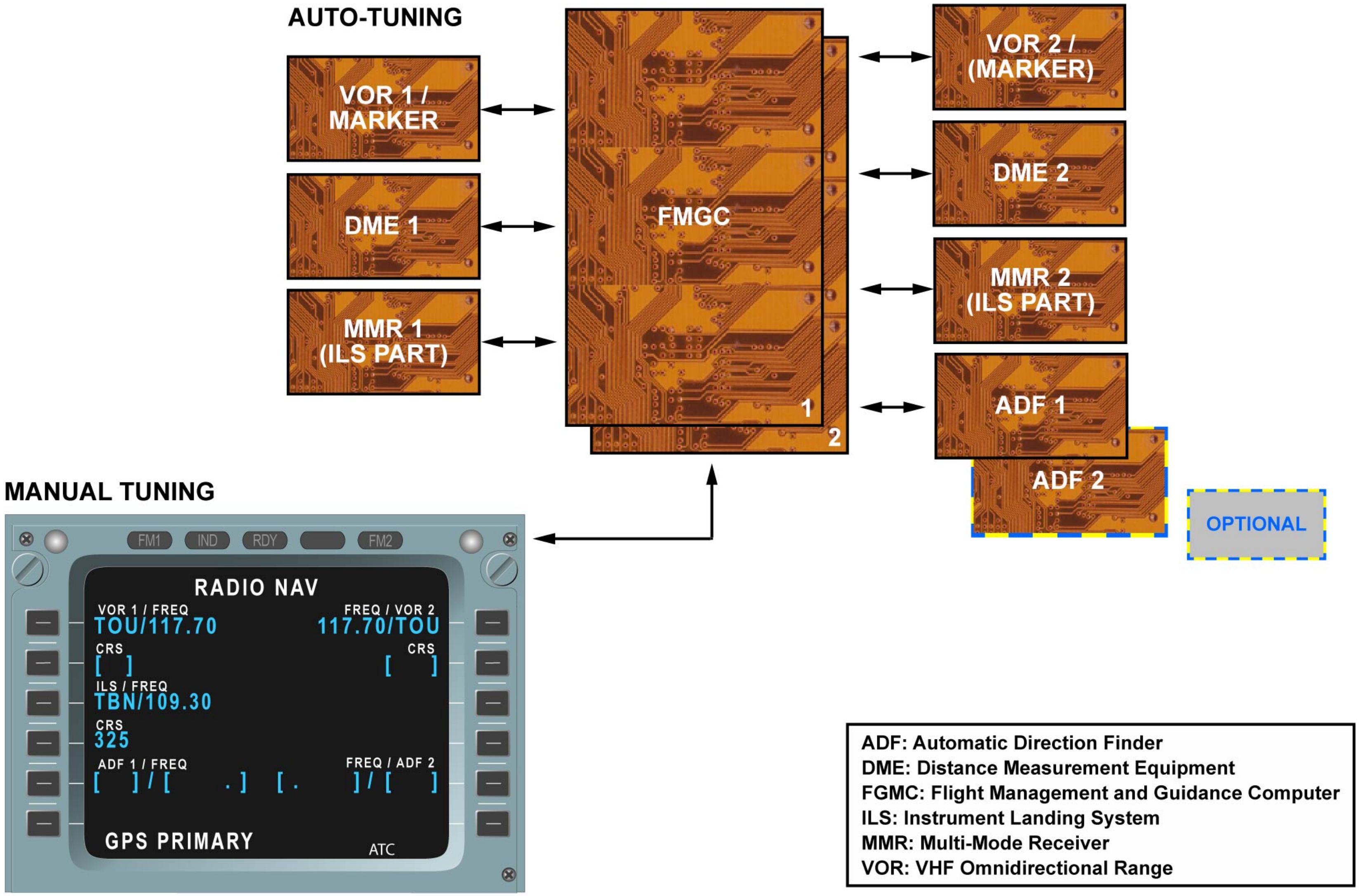
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

RADIO NAVIGATION SYSTEM

The A/C has the following equipment installed:
- two VOR/marker receivers,
- two DMEs interrogators,
- two MMRs: ILS and GPS,
- two ADFs receivers.

NORMAL TUNING

The Flight Management and Guidance Computers (FMGCs) contain the navigation computer function that calculates the aircraft position. The FMGCs tune the radio navigation receivers automatically and use the navigation info from these receivers for display and also in background for A/C position computation. The Jeppesen database is loaded in the FMGCs. This information includes: station identifiers, and specific information (frequency, identification and coordinates) about the station.
Access to the MCDU RADIO NAV page lets the crew manually tune the radio navigation receivers, via the FMGCs for display. Manual tuning overrides automatic tuning.



RADIO NAVIGATION SYSTEM - NORMAL TUNING

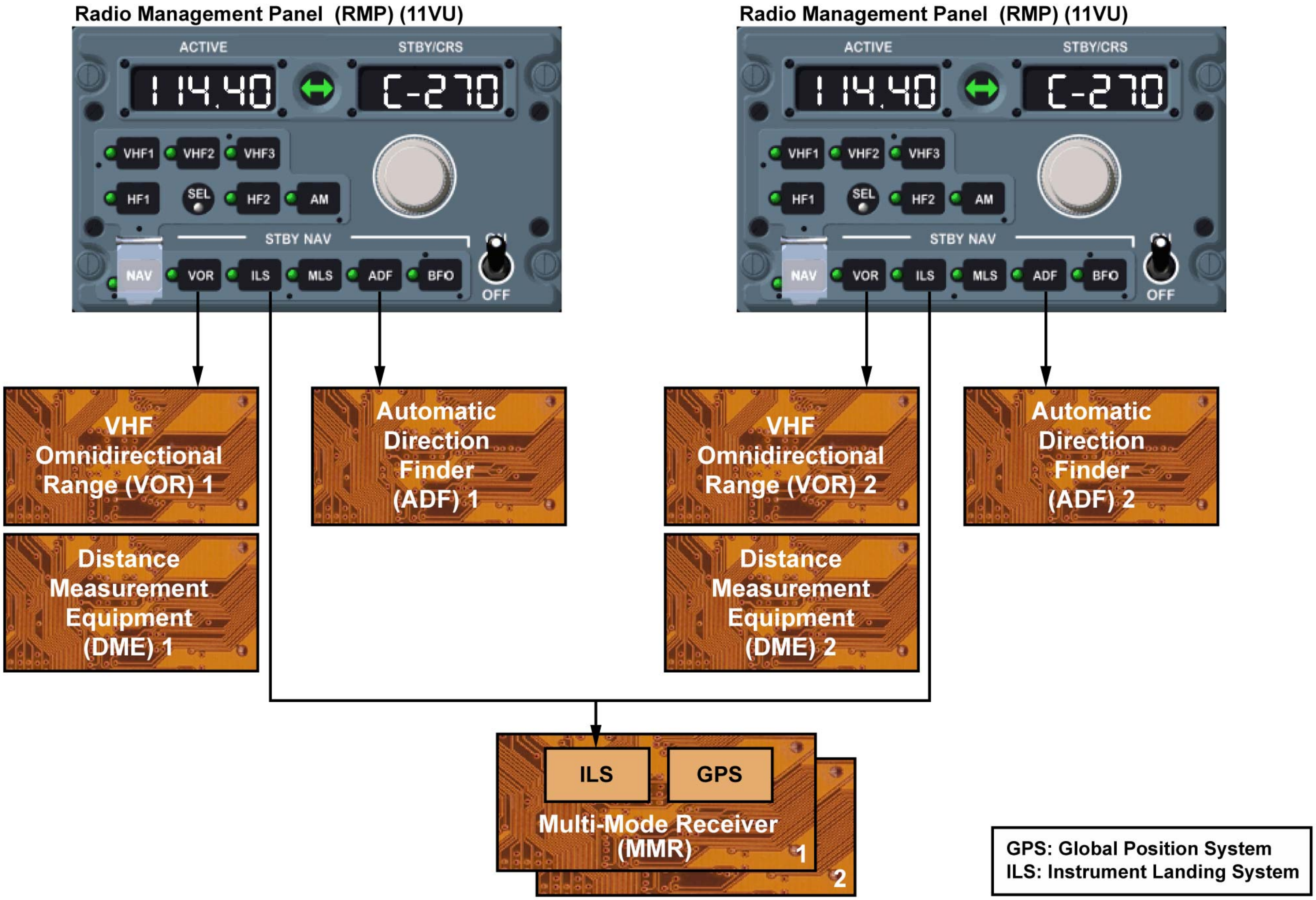
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

RADIO NAVIGATION SYSTEM (continued)

BACKUP TUNING

Radio Management Panel (RMP) 1 and 2 are capable of tuning the own side Navigation receivers in backup mode if both FMGCs have failed or both MCDUs have failed and manual tuning is needed by the crew.



RADIO NAVIGATION SYSTEM - BACKUP TUNING

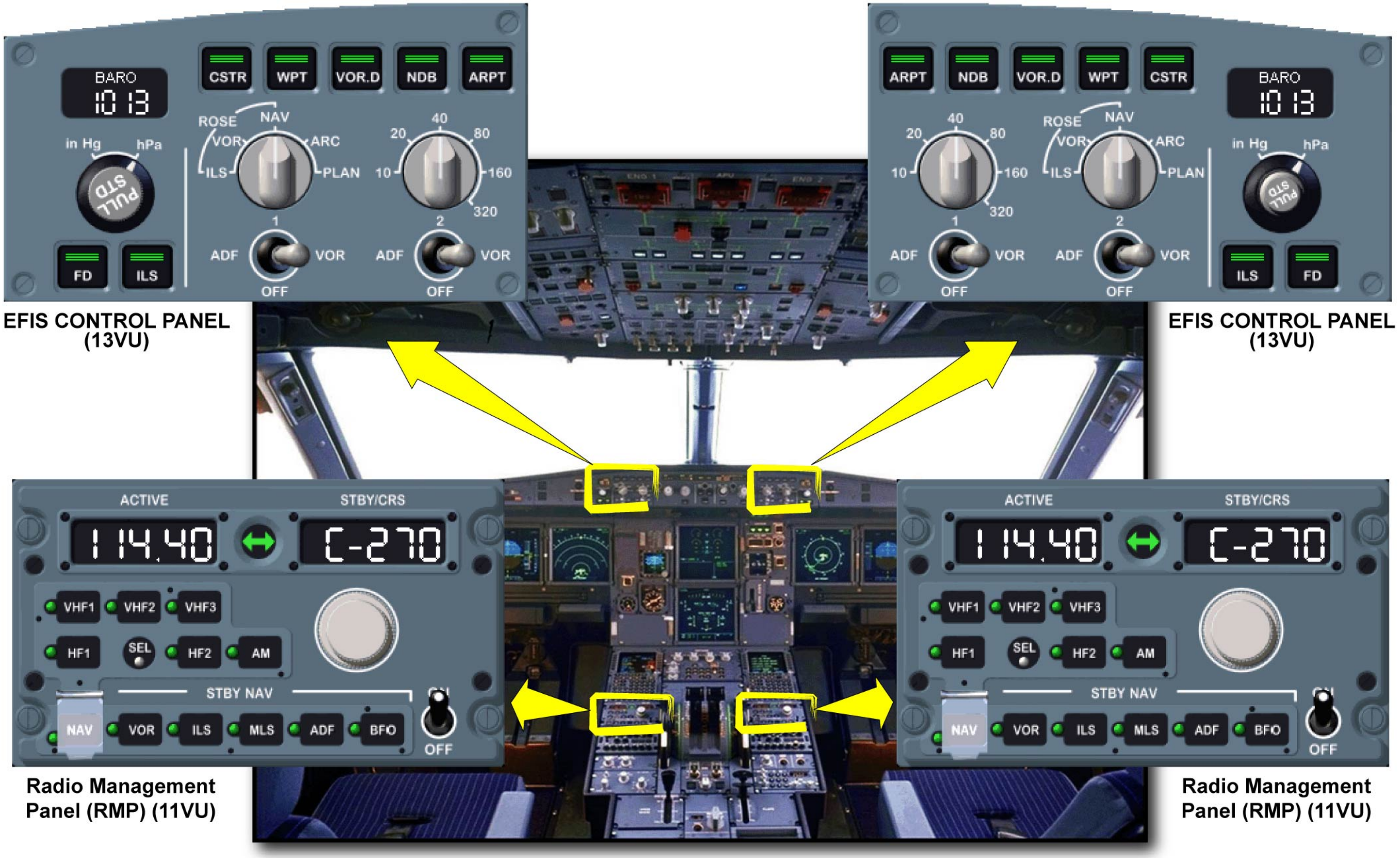
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

RADIO NAVIGATION SYSTEM (continued)

RADIO NAVIGATION CONTROL and INDICATING

The EFIS control panel mode switches control what type of information is shown to the flight crew on the ND. They are located on both sides of the glareshield. The toggle switches on the EFIS control panel enable the display of the VOR or ILS pointers on the ND. RMPs are located on the center pedestal.



RADIO NAVIGATION SYSTEM - RADIO NAVIGATION CONTROL AND INDICATING

U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

RADIO NAVIGATION SYSTEM (continued)

ND MODES

There are five different ND modes that can be selected via the EFIS control panels. These modes are the PLAN, ARC, NAV, VOR, and ILS modes.

U7Z08431 - U0OT4T0 - UM34PY000000002

PLAN MODE

ARC MODE

ILS MODE

VOR MODE

NAV MODE

RADIO NAVIGATION SYSTEM - ND MODES

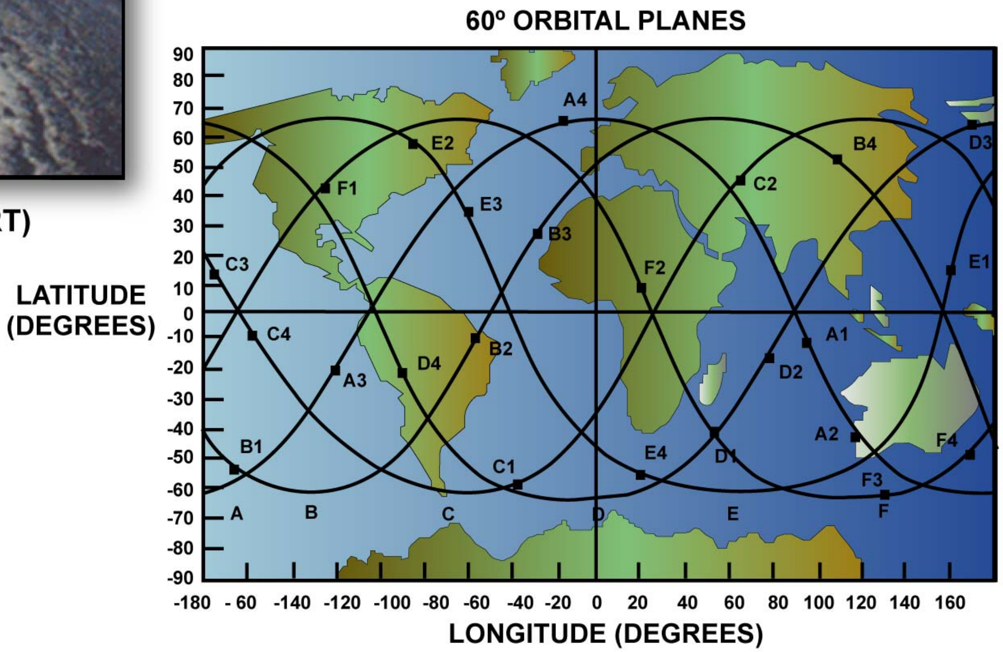
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

MMR (GPS PART) SYSTEM

The GPS receiver uses data sent by 24 satellites.

Multi-Mode Receiver (MMR) (GPS PART)



MMR (GPS PART) SYSTEM

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34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

MMR (GPS PART) SYSTEM (continued)

NETWORK ARCHITECTURE

GPS data may be processed and used by anyone. The satellite system transmits precise phase, and time signals. These signals are decoded, synchronized and triangulated by the receivers.
There are four monitor stations:
- Hawaii,
- Ascension Island,
- Diego Garcia,
- Kwajelein.

There is also a master control station at Colorado Springs. The master control station transmits orbital decay information (Ephemerid data) back to the satellite so that these distance errors can be compensated for the user receiver. The system gives accurate positional altitude and time information. This information is supplied to the FMGCs for aircraft present position calculation.

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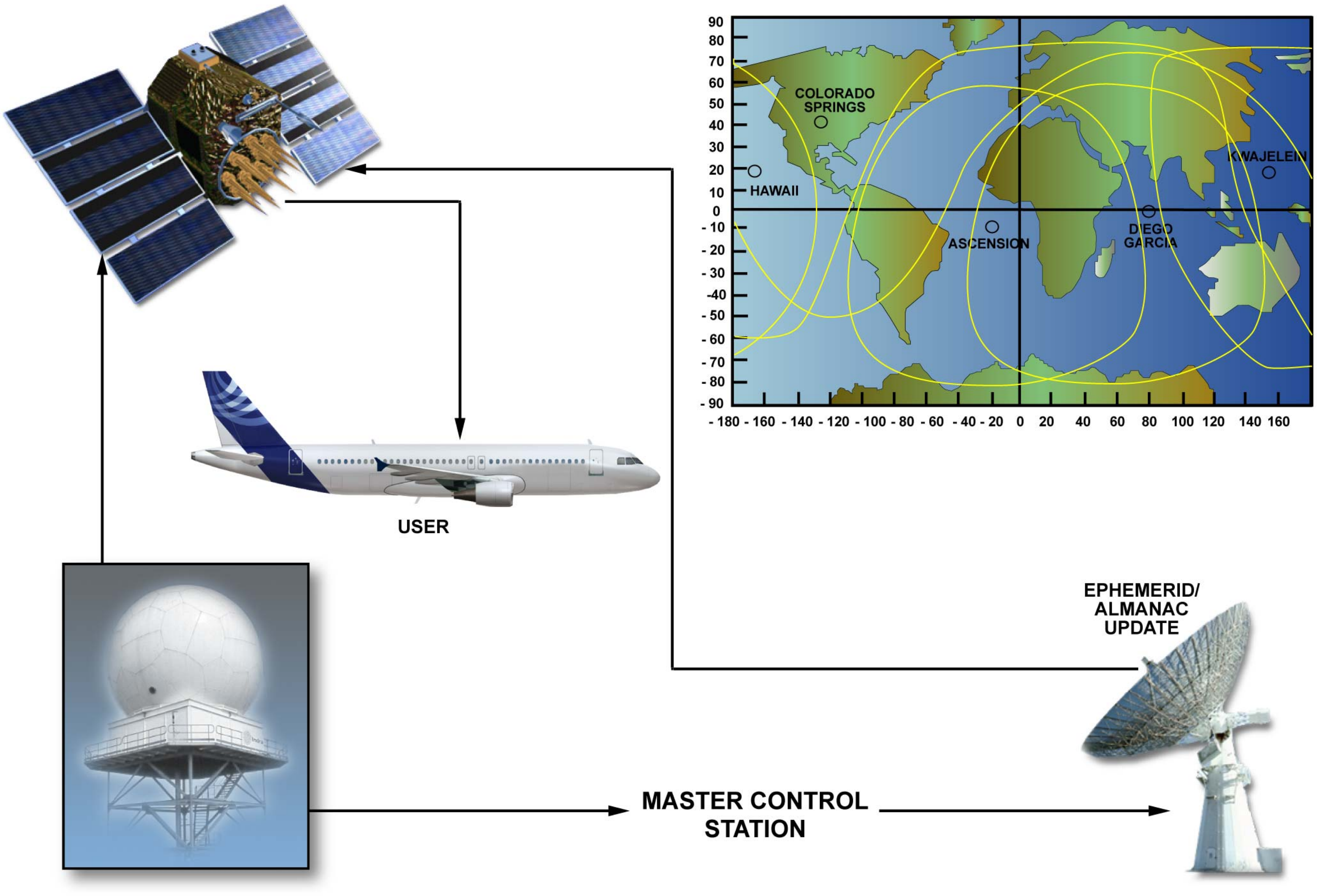
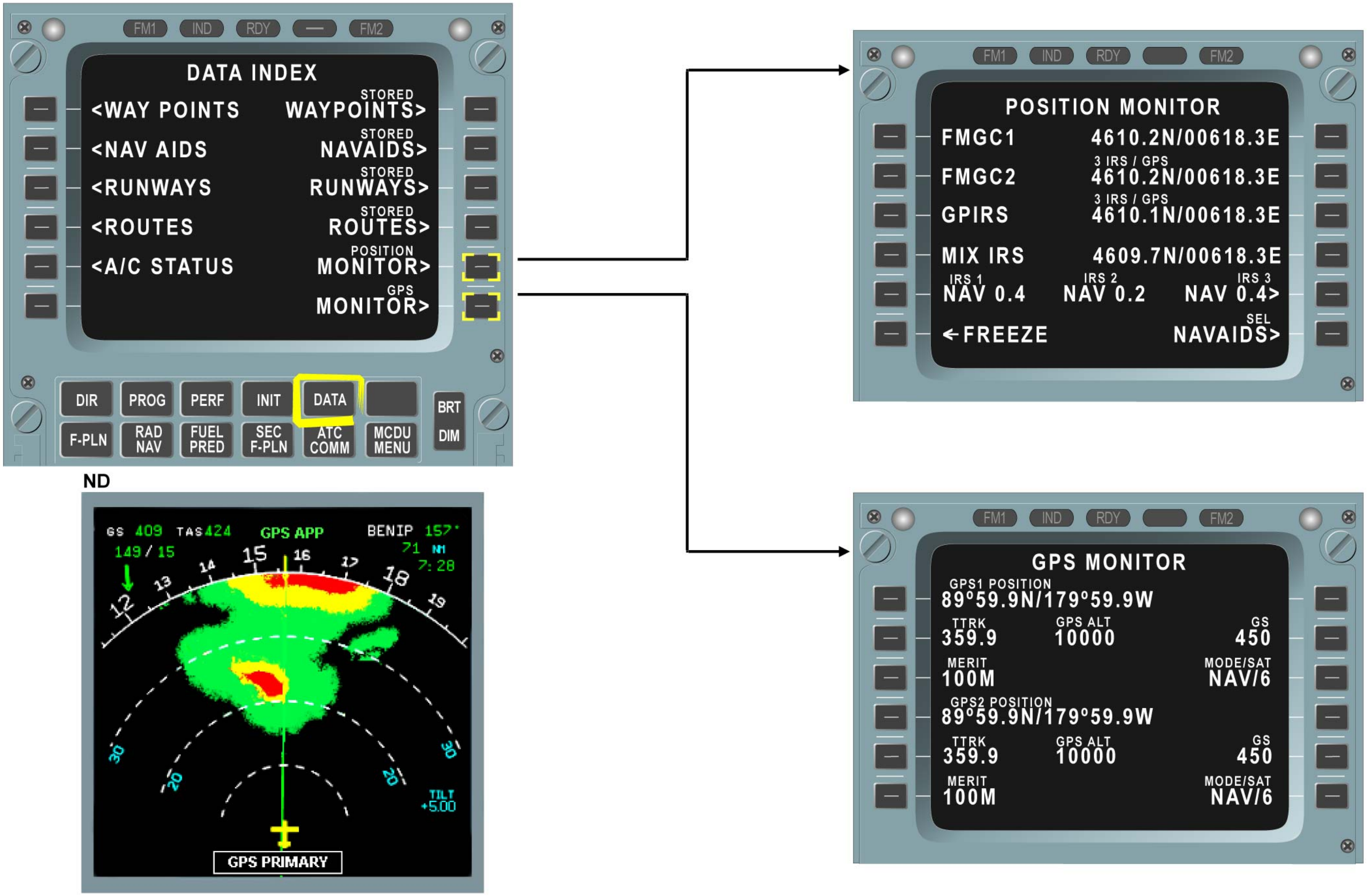


MMR (GPS PART) SYSTEM - NETWORK ARCHITECTURE

MMR (GPS PART) SYSTEM (continued)

GPS CONTROL AND INDICATING

The GPS data is accessible on the MCDU. Selecting DATA page P/B on the MCDU and then the GPS monitor line select key, will give the information related to the GPS receivers.
GPS when receiving adequate signals to calculate a present position will be annotated at the bottom of the ND. This is displayed as "GPS PRIMARY".



MMR (GPS PART) SYSTEM - GPS CONTROL AND INDICATING

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

ATC/TCAS SYSTEM

The Single Aisle family has two ATC transponders, which respond to the ATC secondary surveillance radar and TCAS (or T2CAS option) interrogations.

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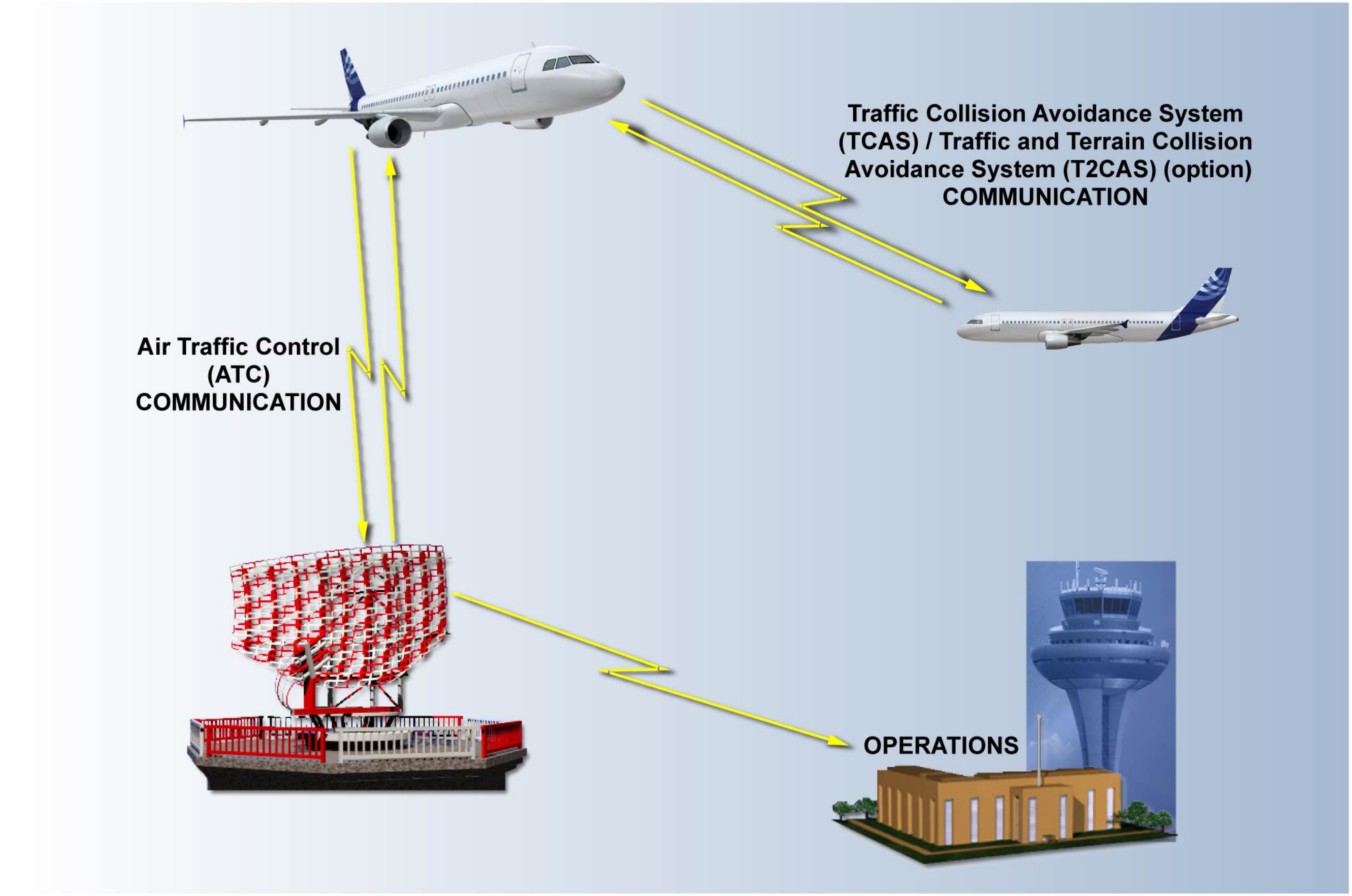


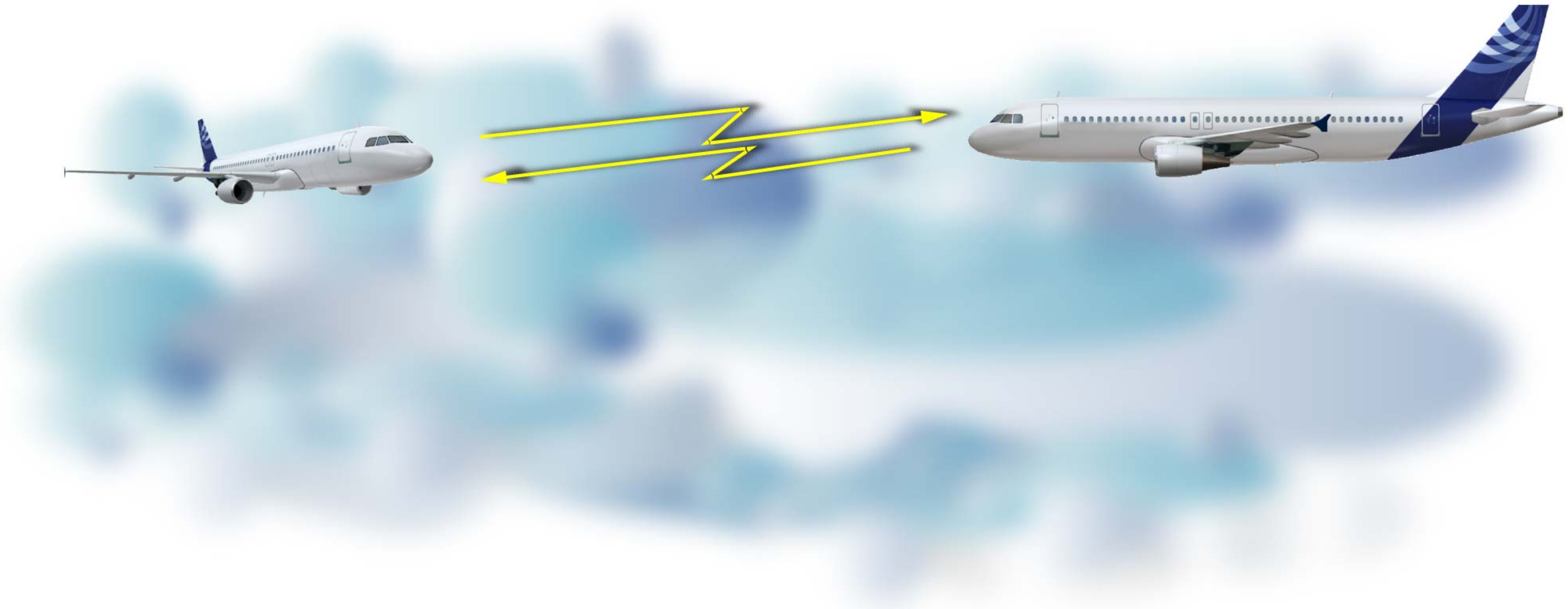
ATC/TCAS SYSTEM

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

ATC/TCAS SYSTEM (continued)

TCAS PRINCIPLE

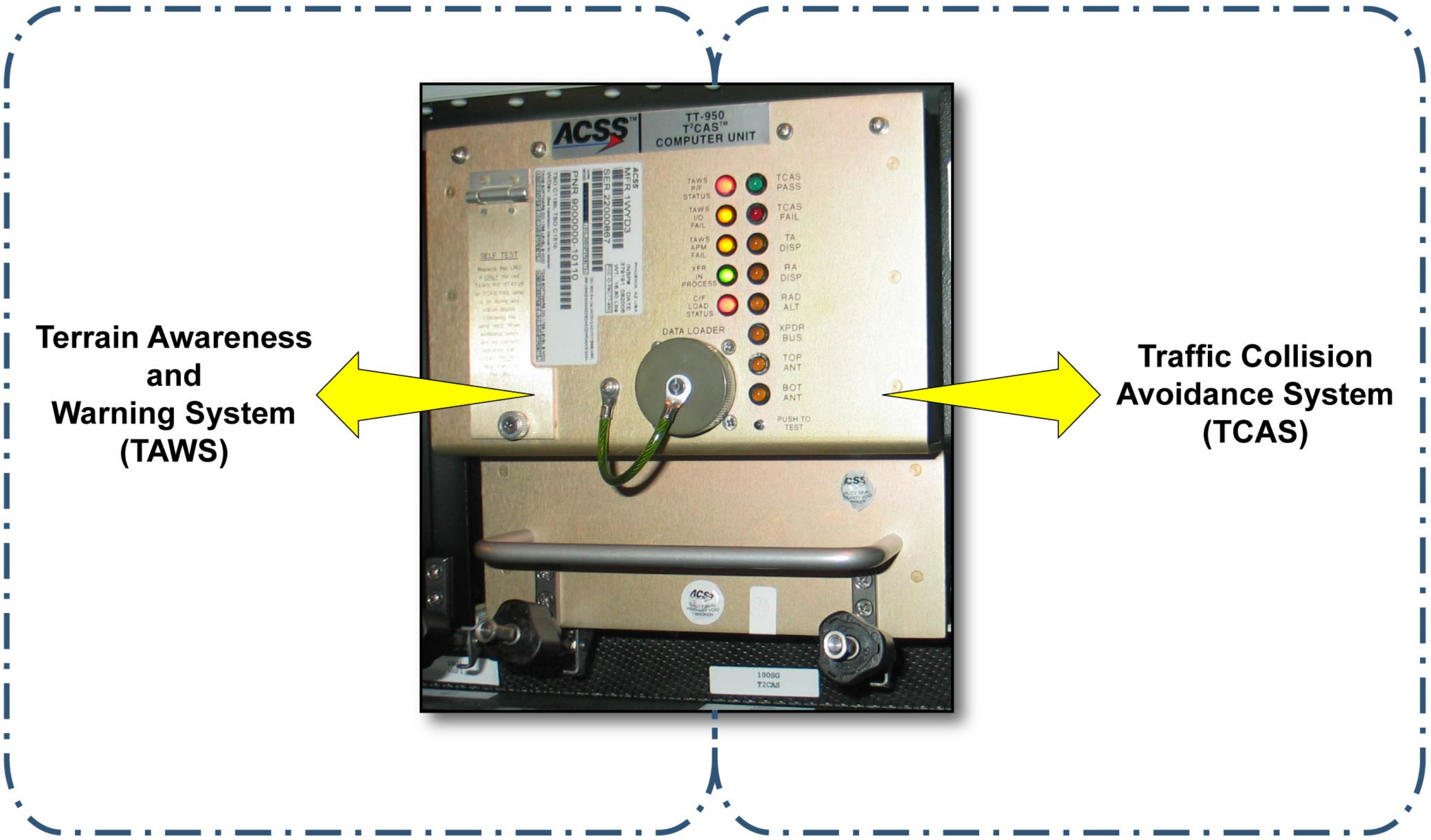
The TCAS gives traffic information and warnings of potential conflicts to the crew, with vertical avoidance instructions. TCAS can only detect and indicate intruders that have at least one operative ATC transponder.
The Traffic and Terrain Collision Avoidance System (T2CAS) is a combination of two functions in a single line replaceable unit (LRU). The Terrain Awareness and Warning System (TAWS) of the T2CAS is the part of the T2CAS that ensures the EGPWS functions. The Traffic Collision avoidance System (TCAS) part of the T2CAS is the part that ensures the same functions as the TCAS.



ATC/TCAS SYSTEM - TCAS PRINCIPLE

U7Z08431 - U0OT4T0 - UM34PY000000002

Terrain and Traffic Collision Avoidance System (T2CAS)



ATC/TCAS SYSTEM - TCAS PRINCIPLE

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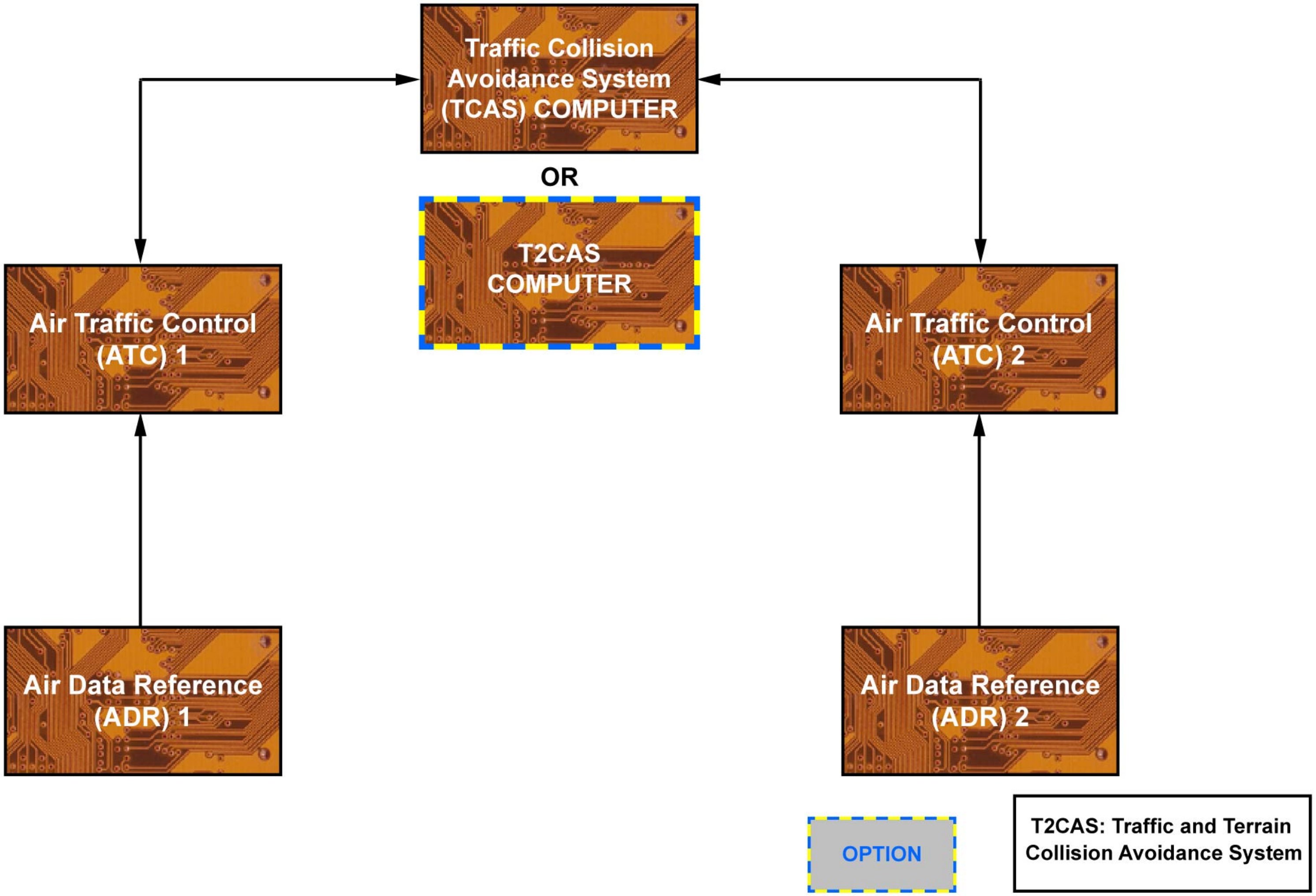
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

ATC/TCAS SYSTEM (continued)

ATC/TCAS SYSTEM

In normal operation Air Data Reference (ADR) 1 supplies barometric information to ATC 1, ADR 2 supplies ATC 2.
The ATC transponder is an integral part of the ATC radar beacon system. The transponder is interrogated by the ground station and replies with a series of pulses. These reply pulses are coded to supply identification MODE A and altitude reporting MODE C, and selective call and flight data MODE S on the Air Traffic Controllers (ATCs) radar scope.
This information enables the controller to distinguish the A/C and to maintain effective ground surveillance of the air traffic.



U7Z08431 - U0OT4T0 - UM34PY000000002

ATC/TCAS SYSTEM - ATC/TCAS SYSTEM

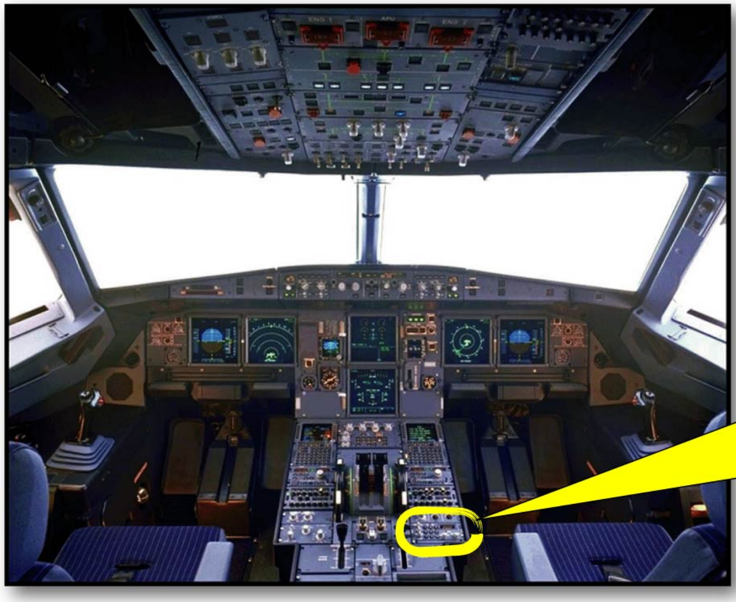
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

ATC/TCAS SYSTEM (continued)

ATC/TCAS CONTROL AND INDICATING

The single control panel on the center pedestal is used for the controls of the ATC and TCAS (or T2CAS) systems.

U7Z08431 - U0OT4T0 - UM34PY000000002



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ATC/TCAS SYSTEM - ATC/TCAS CONTROL AND INDICATING

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

ATC/TCAS SYSTEM (continued)

TCAS INDICATING

Here are the different indications that are given by the TCAS (or T2CAS) computer linked to audio warnings.

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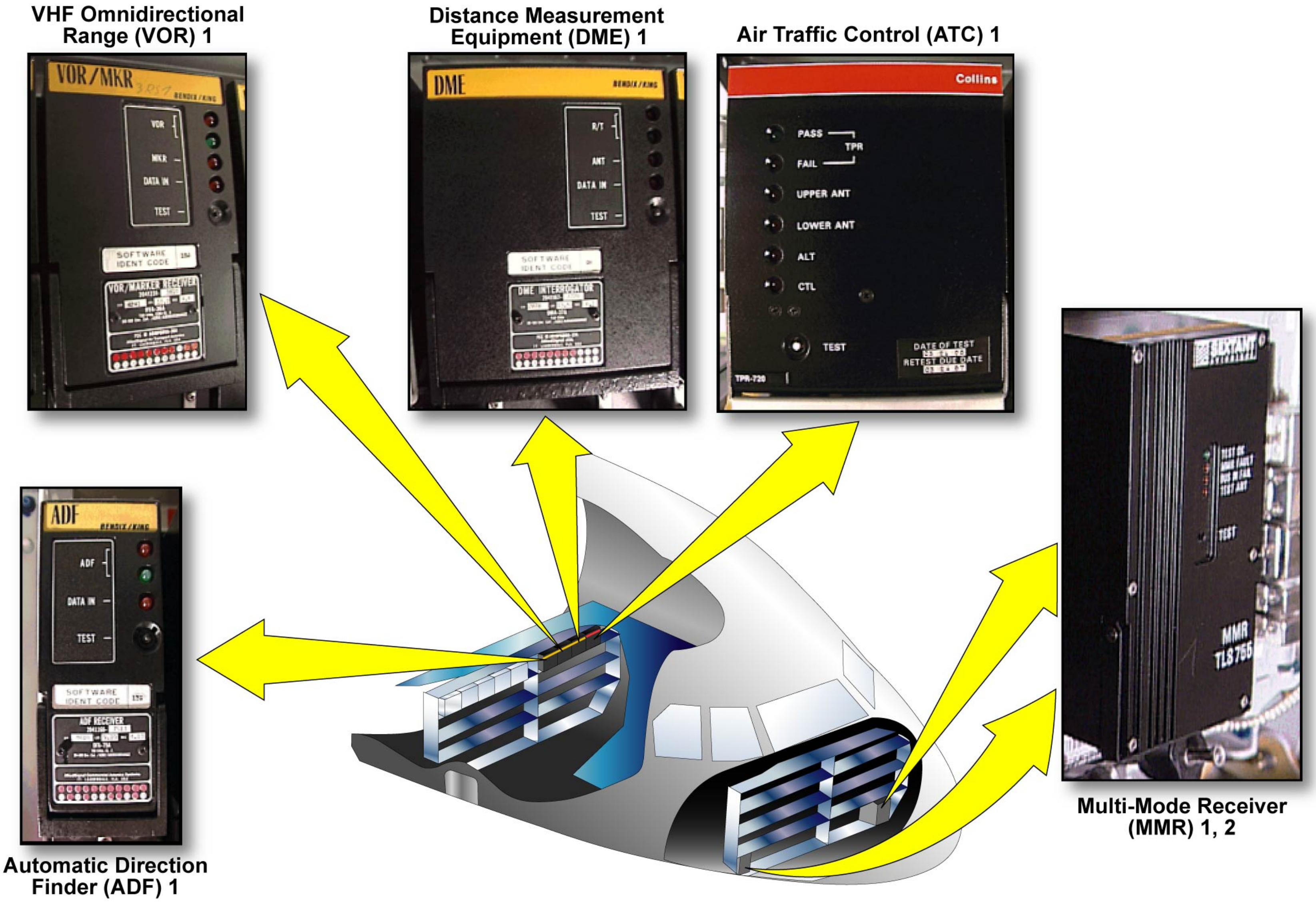
ATC/TCAS SYSTEM - TCAS INDICATING

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

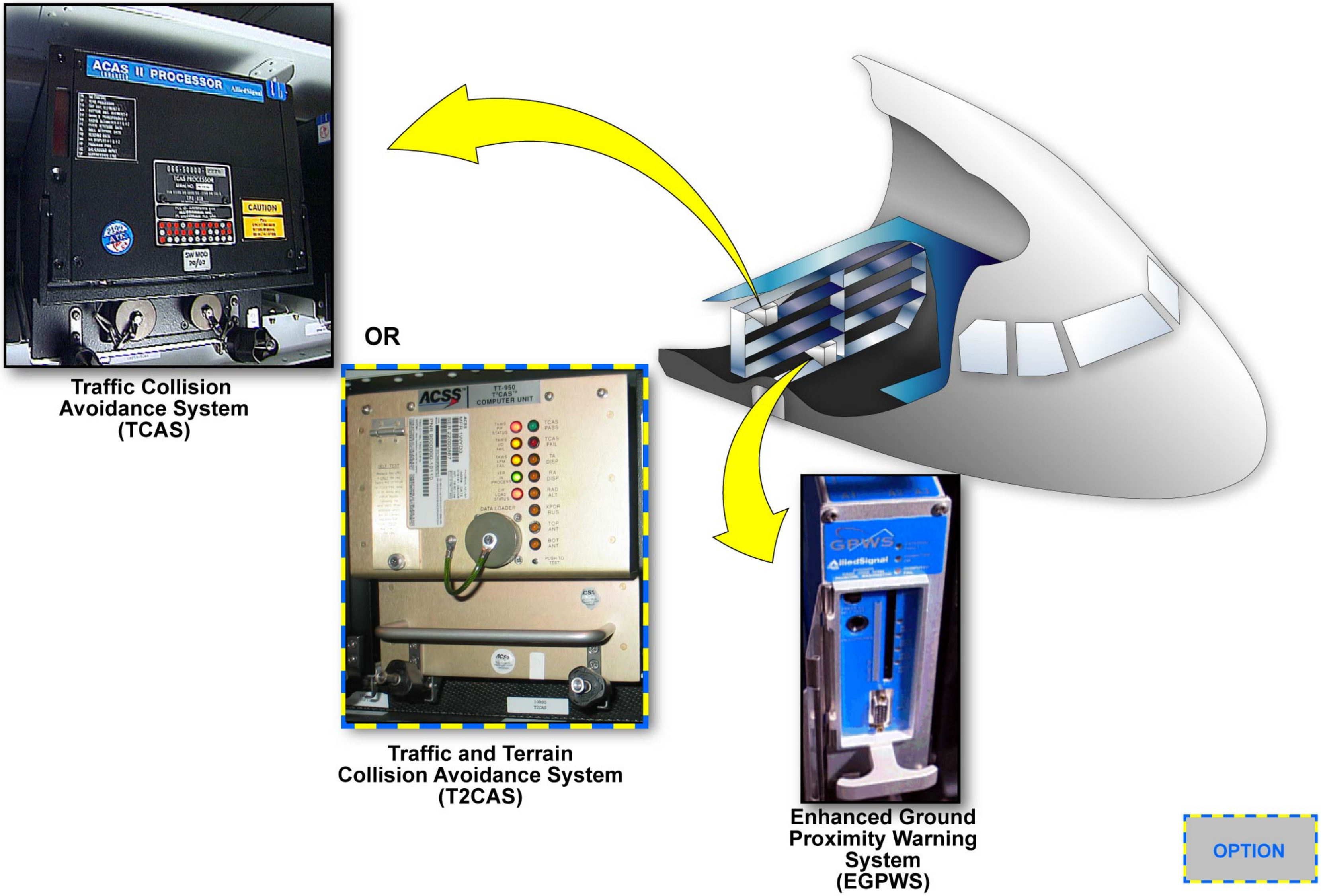
COMPONENT LOCATION

Let's see the location of the different navigation systems LRUs.
The radio navigation receiver antennae are located on the upper and lower fuselage:
- DME,
- ATC,
- ADF,
- VOR,
- MMR.

The radio navigation receiver antennae are located on the upper and lower fuselage:
-TCAS (or T2CAS),
- Enhanced Ground Proximity Warning System (EGPWS).



COMPONENT LOCATION



COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM34PY000000002

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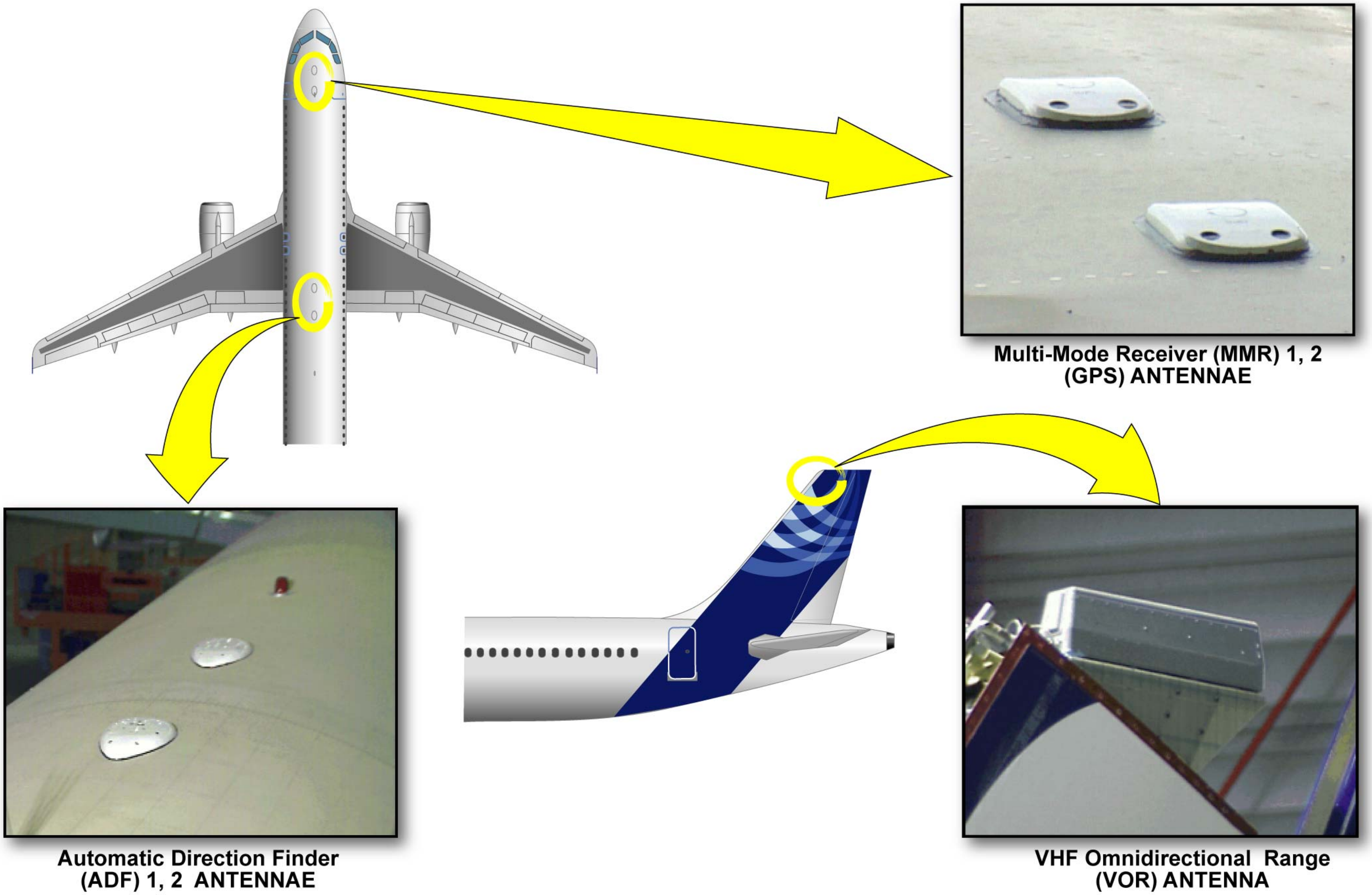
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

COMPONENT LOCATION (continued)

NAVIGATION ANTENNAS LOCATION (1/3)

The MMR, ADF and VOR antennae are installed on the upper and lower portion of the fuselage.

U7Z08431 - U0OT4T0 - UM34PY000000002



COMPONENT LOCATION - NAVIGATION ANTENNAS LOCATION (1/3)

U7Z08431 - U0OT4T0 - UM34PY000000002

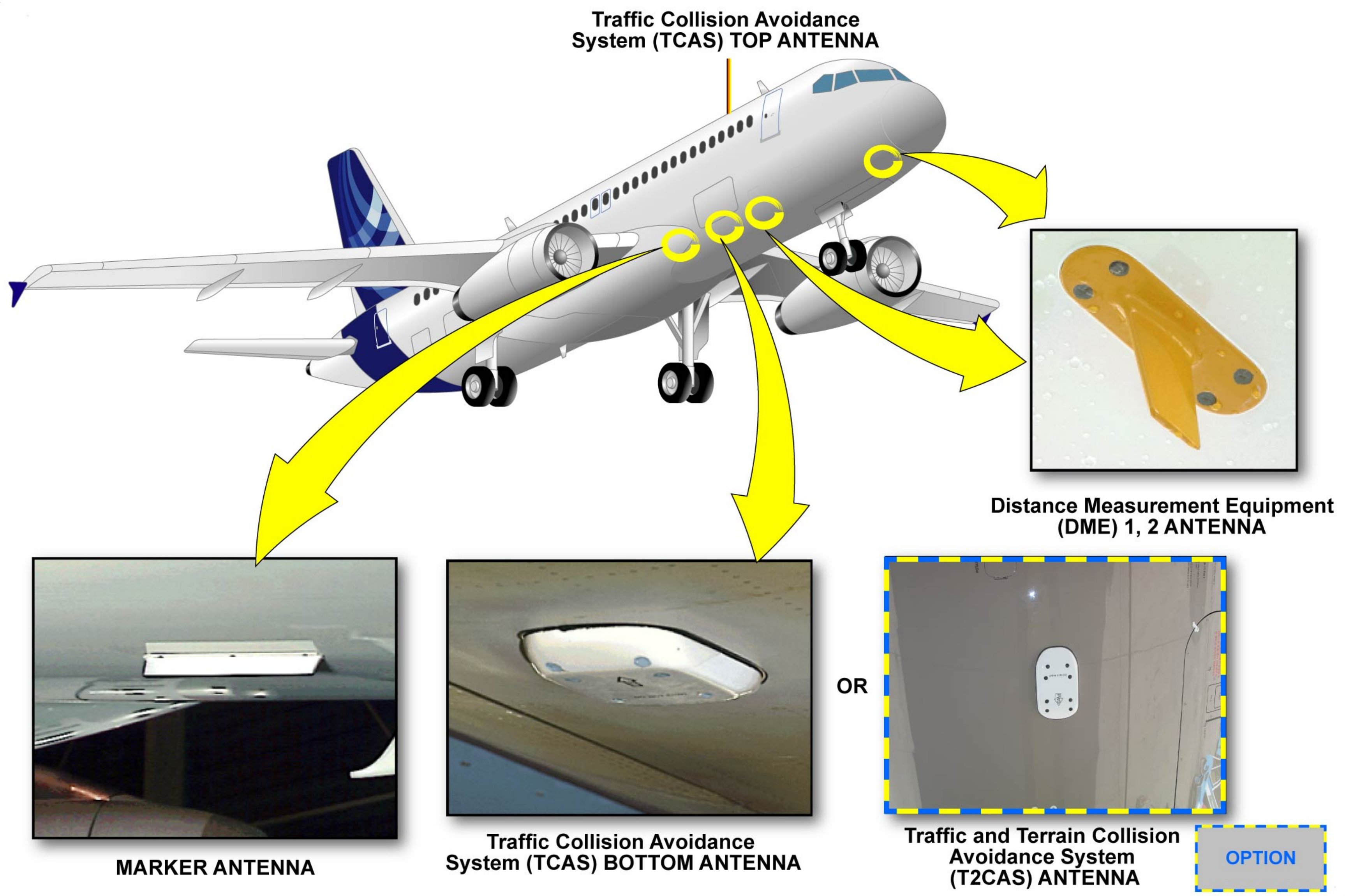
34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

COMPONENT LOCATION (continued)

NAVIGATION ANTENNAS LOCATION (2/3)

The marker antenna and DME antennae are installed on the lower portion of the fuselage. There are also two TCAS (or T2CAS) antennae, (1 at the top, 1 at the bottom).

U7Z08431 - U0OT4T0 - UM34PY000000002



COMPONENT LOCATION - NAVIGATION ANTENNAS LOCATION (2/3)

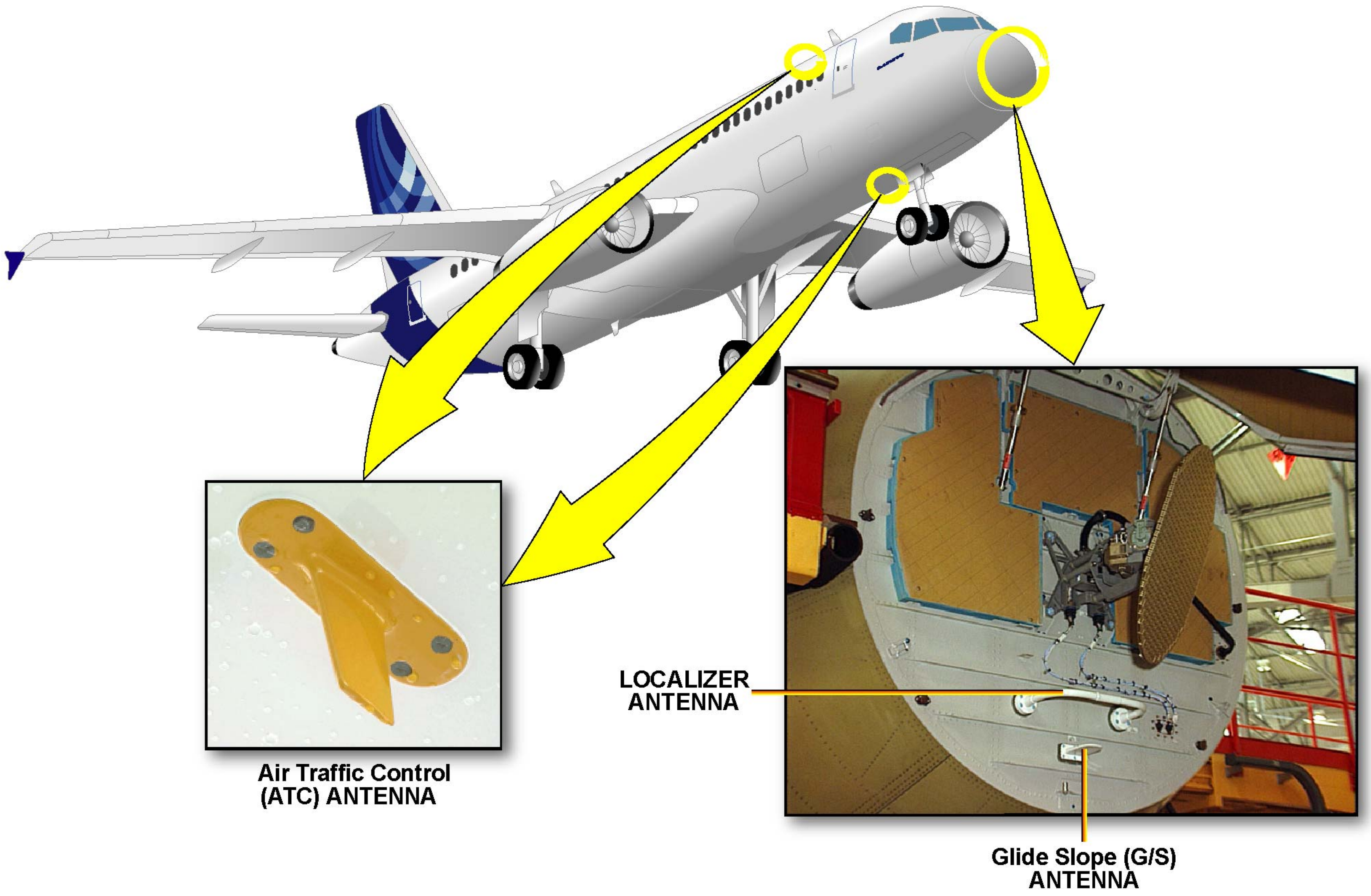
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

COMPONENT LOCATION (continued)

NAVIGATION ANTENNAE LOCATION (3/3)

The four ATCs antennae are located on the upper and lower portion of the fuselage.
The G/S and Localizer (LOC) dual antennae are located in the radome.



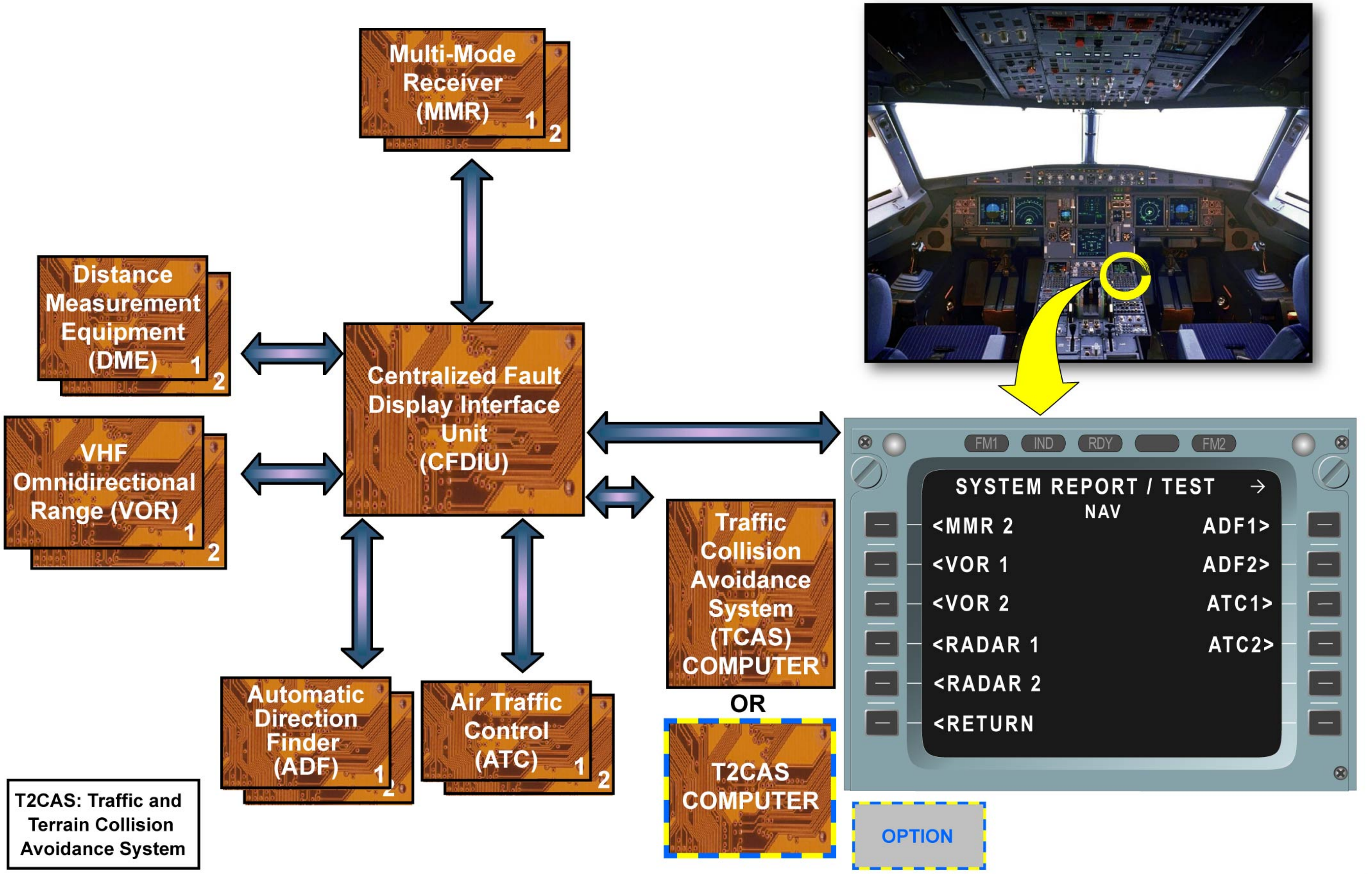
COMPONENT LOCATION - NAVIGATION ANTENNAE LOCATION (3/3)

U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

MAINTENANCE/TEST FACILITIES

All navigation systems can be tested from the MCDUs.



MAINTENANCE/TEST FACILITIES

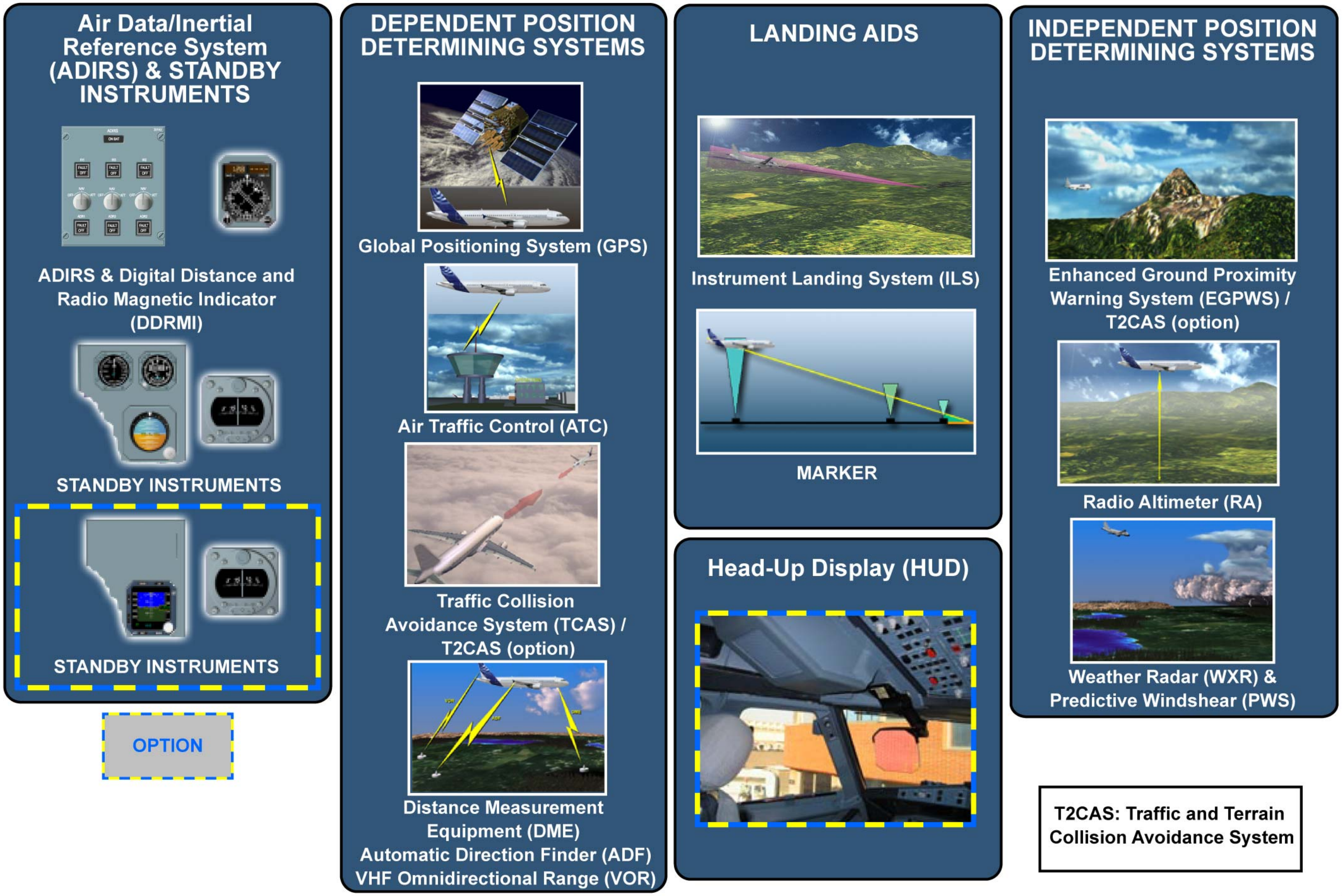
U7Z08431 - U0OT4T0 - UM34PY000000002

34 DEPENDENT POS DETERMINING SYS & LAND AIDS (1)

SUMMARY

This picture lists the navigation systems that are installed on the Single Aisle A/C.

U7Z08431 - U0OT4T0 - UM34PY000000002



SUMMARY

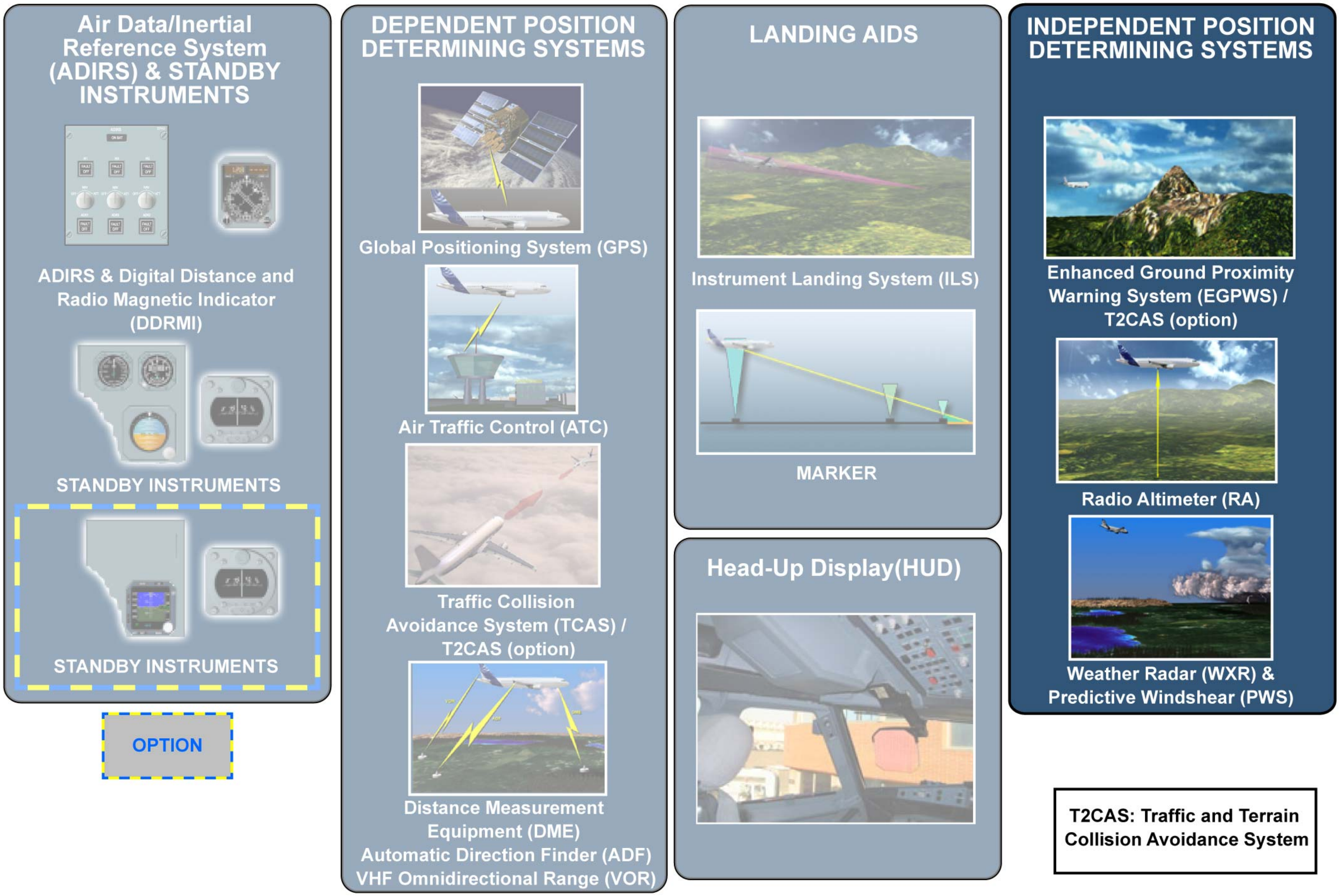
U7Z08431 - U0OT4T0 - UM34PY000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

GENERAL

The Independent Position determining systems include:
- Enhanced Ground Proximity Warning System (EGPWS) or Traffic and Terrain Collision Avoidance System (T2CAS) as option,
- Radio Altimeters (RAs),
- Weather Radar (WXR) and Predictive Windshear (PWS).

These systems do not rely on external sources to provide the flight crew with position determination.



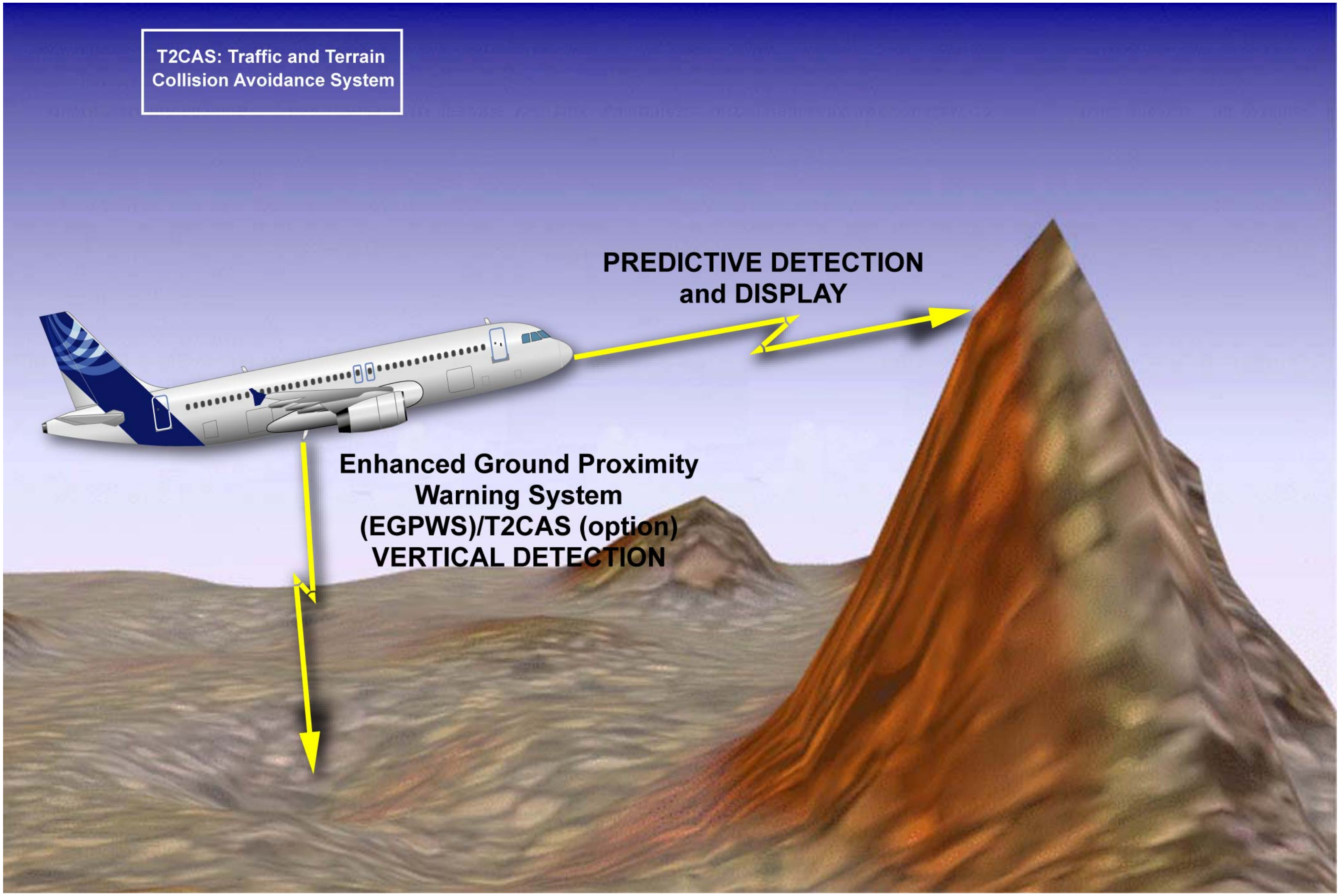
GENERAL

U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

EGPWS

The purpose of the EGPWS is to generate aural and visual warnings if the A/C adopts a potentially hazardous configuration of Controlled Flight Into Terrain (CFIT).
This system has five basic Enhanced Ground Proximity Warning System (EGPWS) modes and has 2 TERRAIN modes called TERRAIN Clearance Function (TCF) and the TERRAIN Awareness and Display (TAD).
As an option, the T2CAS can replace the EGPWS.



EGPWS

U7Z08431 - U0OT4T0 - UM34PX000000002

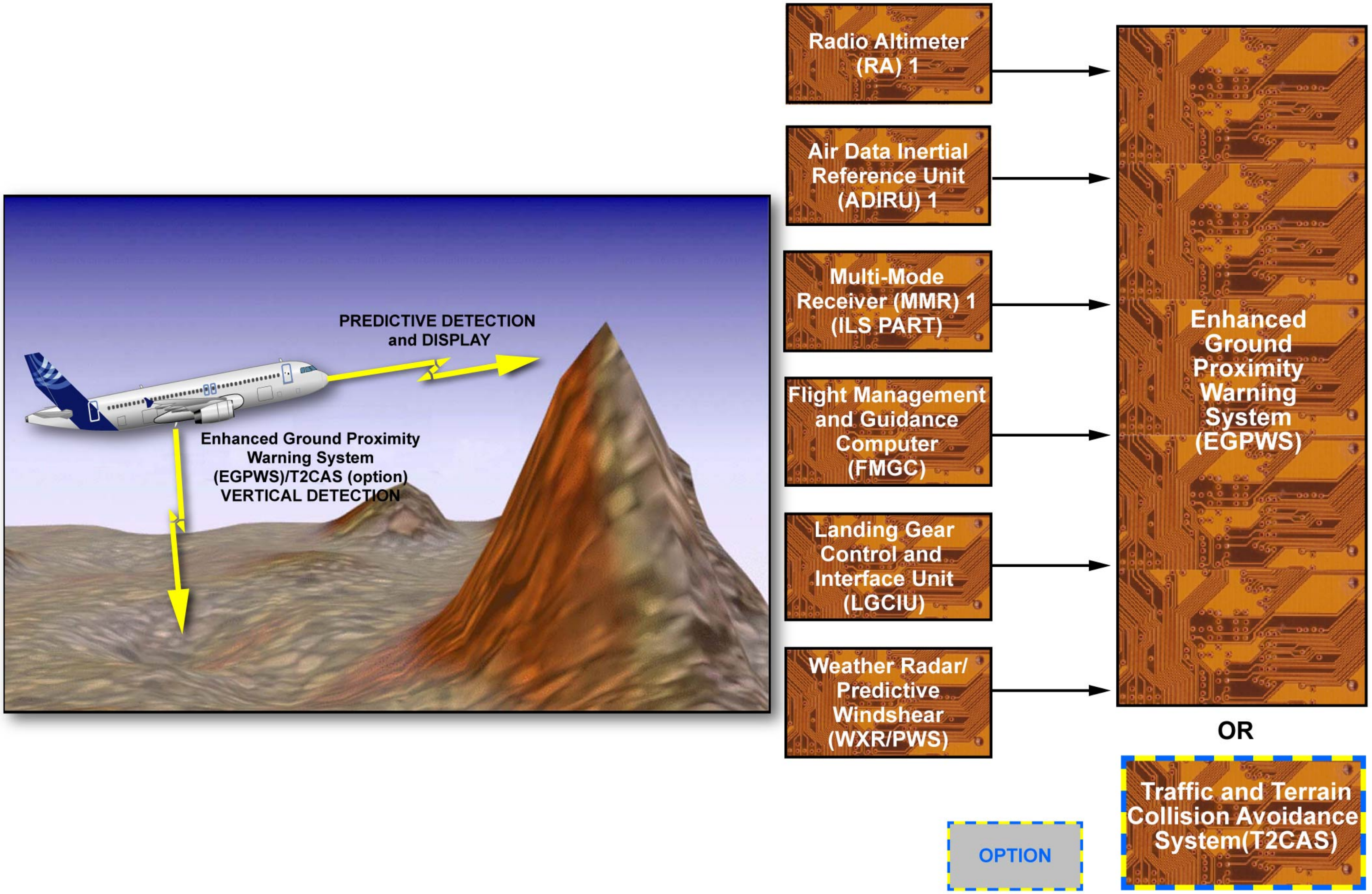
34 INDEPENDENT POS DETERMINING SYS PRES. (1)

EGPWS (continued)

SYSTEM ARCHITECTURE

The EGPWS computer (or T2CAS computer as an option) processes the data from:
- RA 1,
- Air Data/Inertial Reference Unit (ADIRU) 1,
- Multi-Mode Receiver (MMR) 1 (Instrument Landing System (ILS) part),
- Flight Management and Guidance Computer (FMGC) 1,
- Landing Gear Control and Interface Unit (LGCIU) 1,
- WXR/PWS (for ND image source selection between both systems).

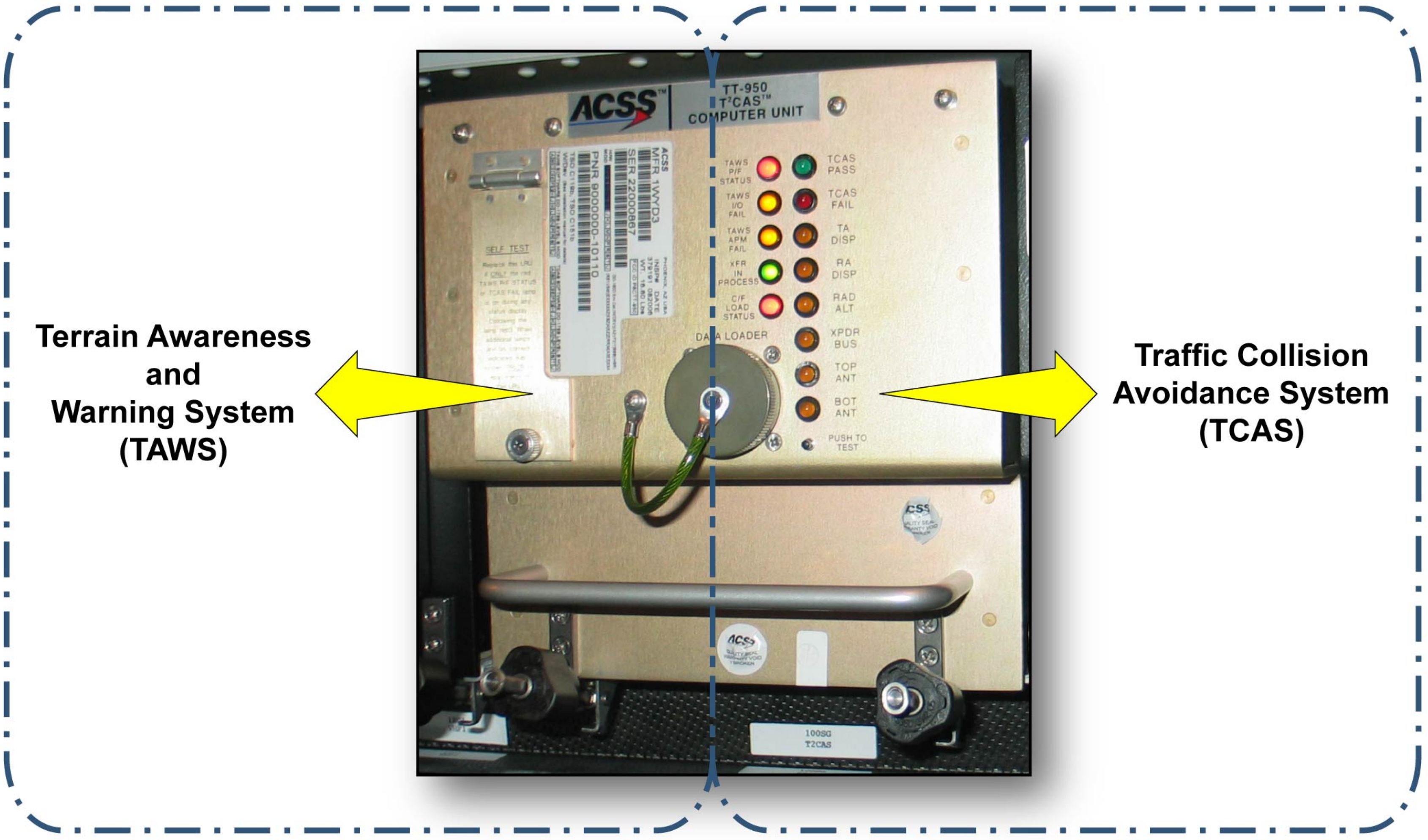
The Traffic Collision avoidance System (TCAS) part of the T2CAS is the part that ensures the TCAS functions.
The Terrain Awareness and Warning System (TAWS) of the T2CAS is the part of the T2CAS that ensures the EGPWS functions such as:
- basic TAWS modes base on Radio Altitude (RA),
- predictive TAWS modes: Collision Prediction and Alerting (CPA) function and Terrain Hazard Display (THD) which provides a forward-looking terrain alerting capability.



EGPWS - SYSTEM ARCHITECTURE

U7Z08431 - U0OT4T0 - UM34PX000000002

Terrain and Traffic Collision Avoidance System (T2CAS)



EGPWS - SYSTEM ARCHITECTURE

U7Z08431 - U0OT4T0 - UM34PX000000002

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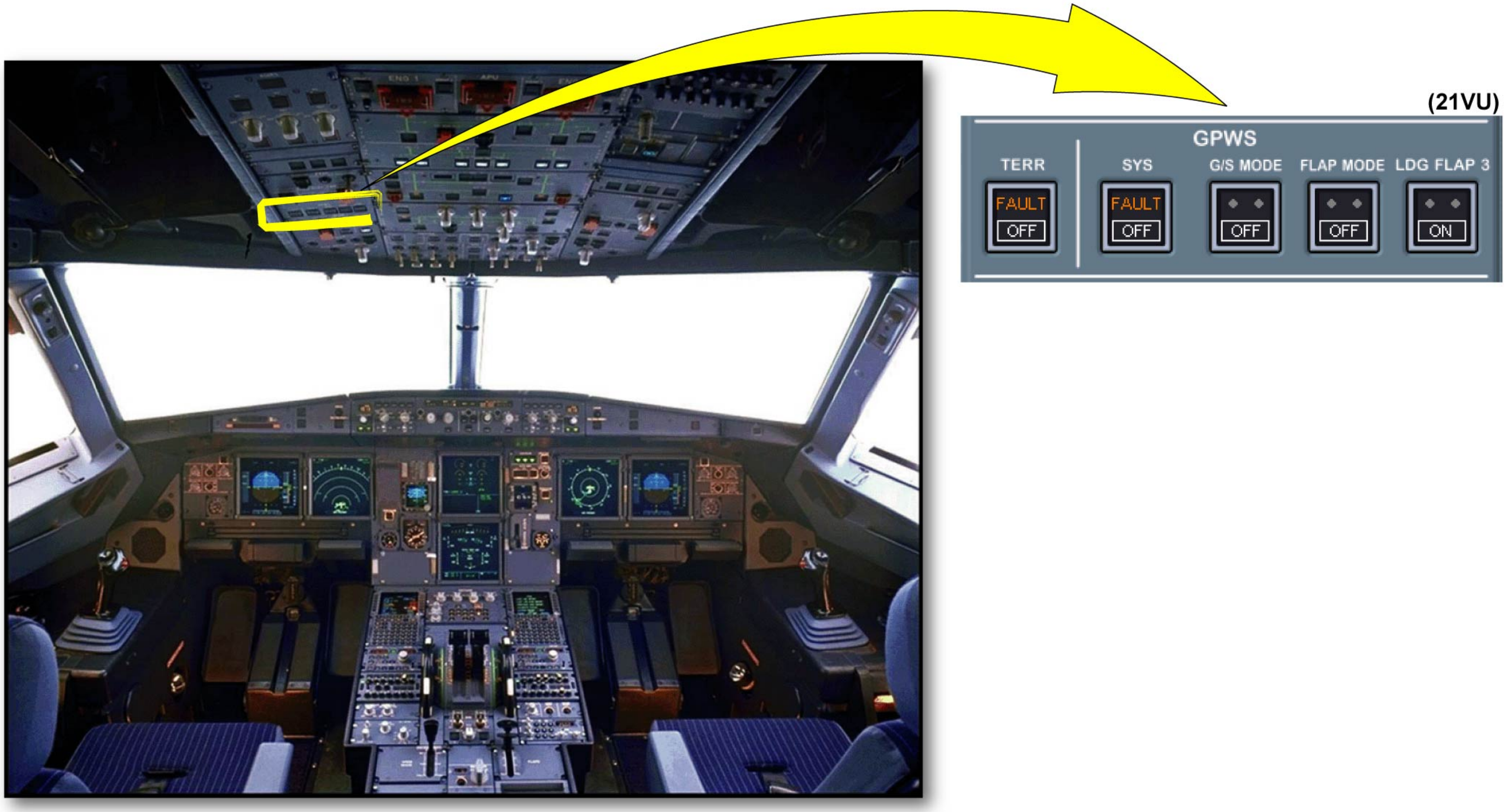
34 INDEPENDENT POS DETERMINING SYS PRES. (1)

EGPWS (continued)

GPWS PANEL

The GPWS/T2CAS control panel is located on the overhead panel and enables the deactivation of:
- TERRAIN mode,
- complete or partial basic EGPWS mode in specific approach configuration.

U7Z08431 - U0OT4T0 - UM34PX000000002



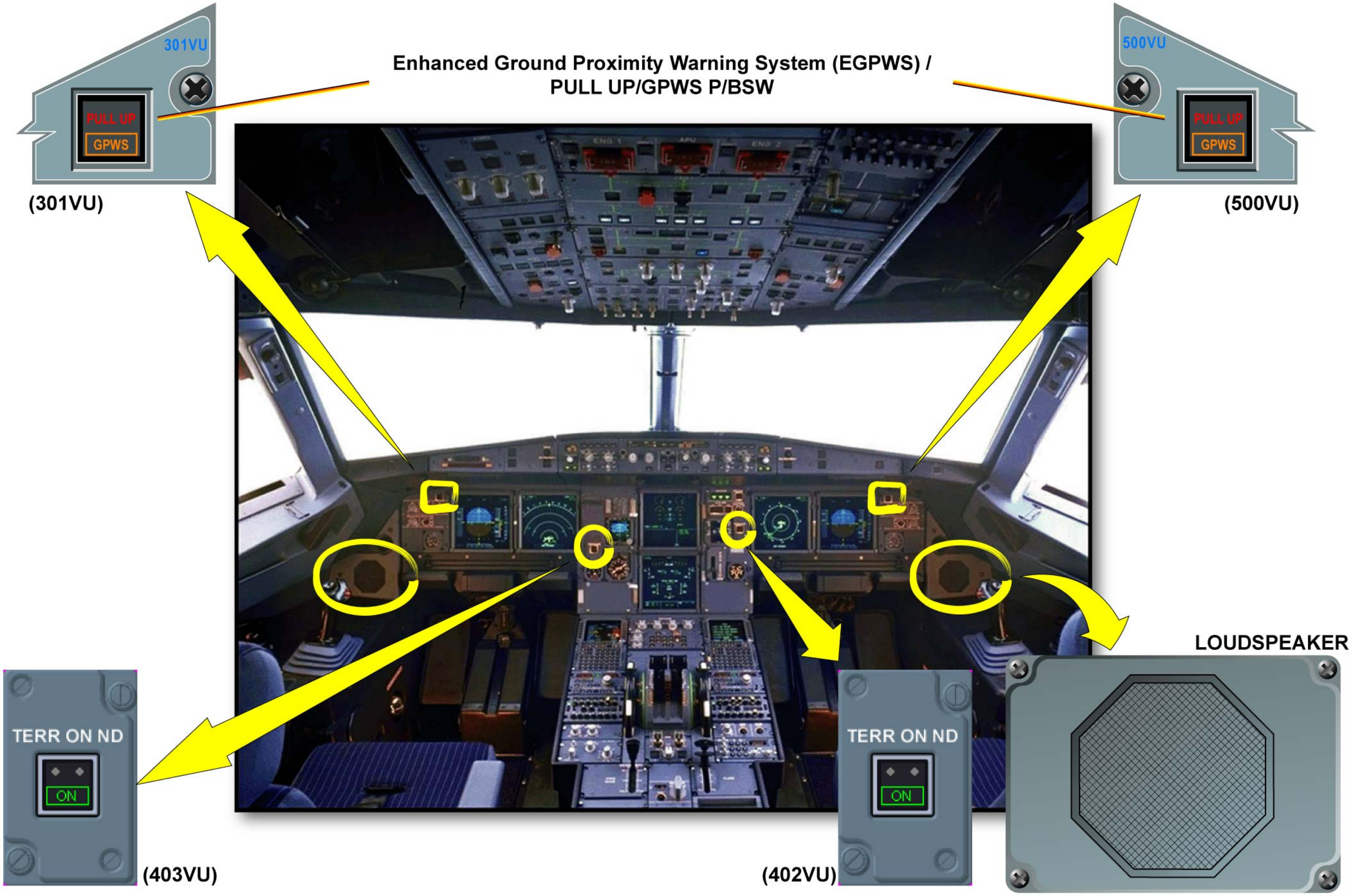
EGPWS - GPWS PANEL

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

EGPWS (continued)

CONTROL AND INDICATING

EGPWS and T2CAS have the same visual warnings, that are shown on the instrument panels. The systems can be tested by pressing either of the PULL UP/GPWS P/BSW.
In addition, two loudspeakers installed on each lower side of the main panel broadcast EGPWS/T2CAS aural warnings, even if loudspeaker knobs are turned off.
Terrain information will be automatically displayed on the ND if there is any danger within the proximity of the A/C. The terrain elevation surrounding the A/C is color coded. The TERRain ON ND P/B is used to display the terrain information on the ND all the time on request.



EGPWS - CONTROL AND INDICATING

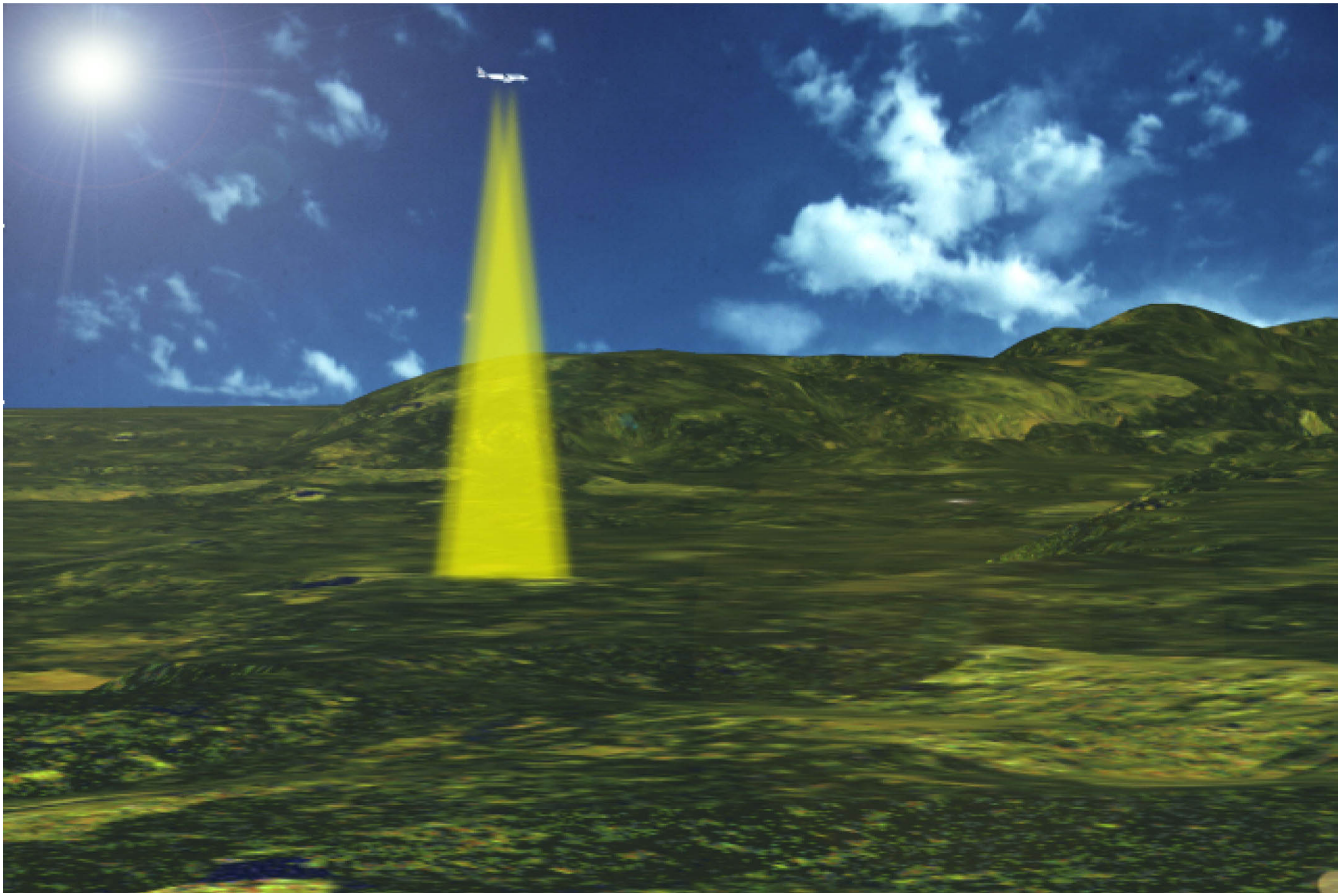
U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

RADIO ALTIMETER

The RAs supply accurate measurement of the A/C height above the ground during initial climb, landing and approach phases.

U7Z08431 - U0OT4T0 - UM34PX000000002



RADIO ALTIMETER

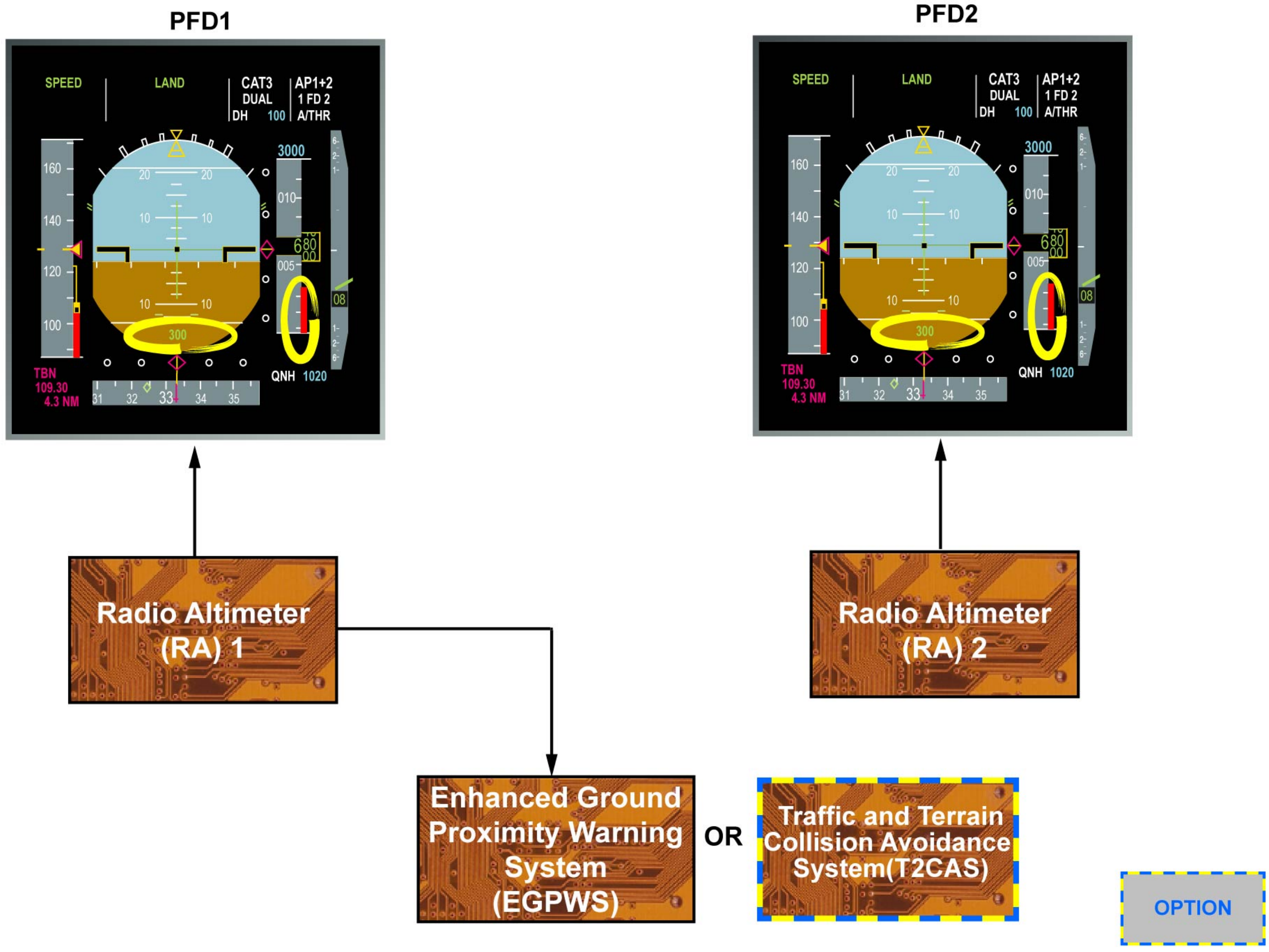
U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

RADIO ALTIMETER (continued)

CONTROL AND INDICATING

RA data is supplied to several users and is displayed on both PFDs at all times below 2500 feet Above Ground Level (AGL).
In normal operation, the RA 1 height is displayed on the CAPT PFD and RA 2 height on the F/O PFD.

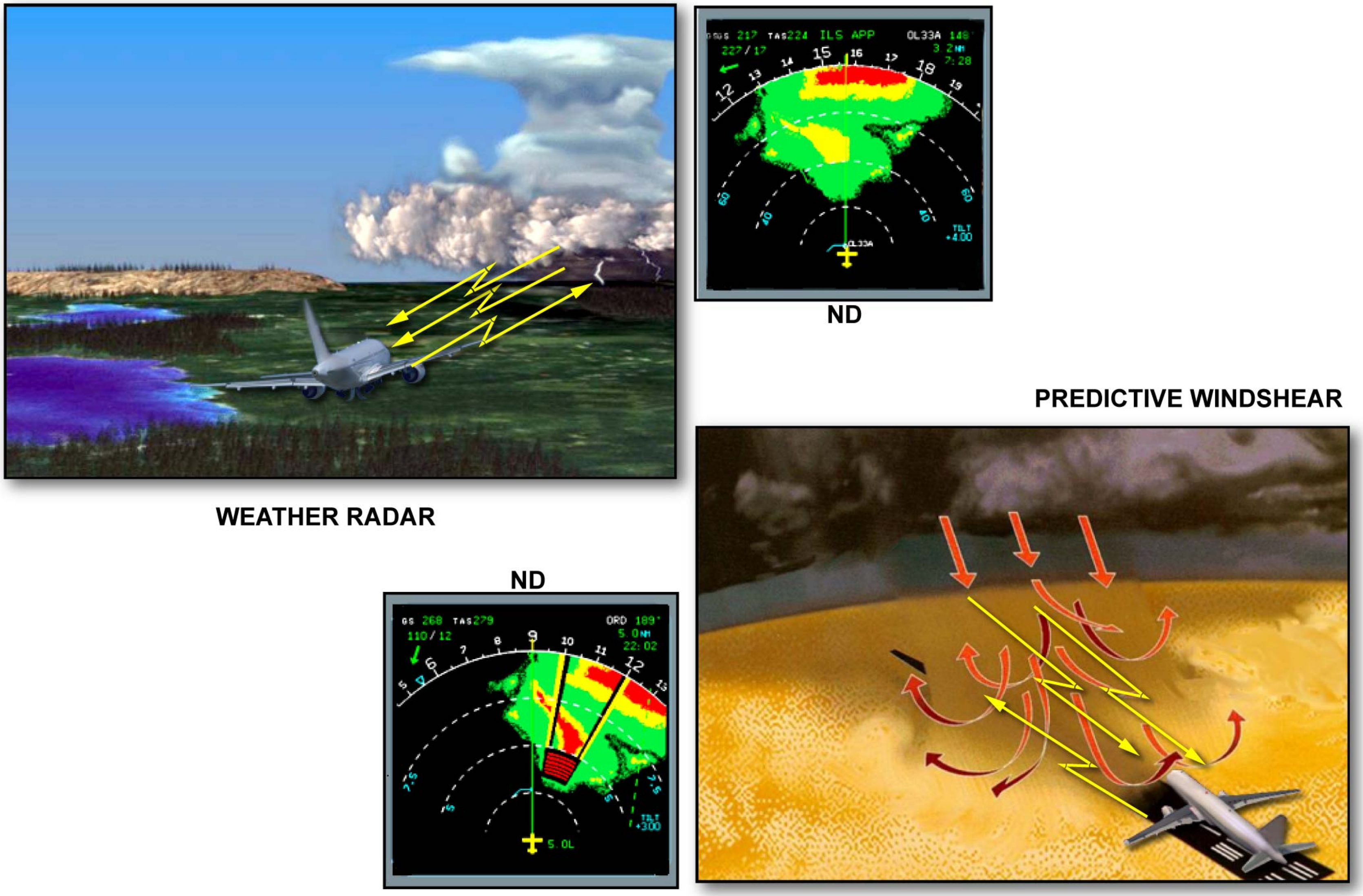


RADIO ALTIMETER - CONTROL AND INDICATING

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

WXR/PWS

WXR is installed to detect precipitation. The displayed returns are shown on the ND.
The weather radar supplies PWS detection. A wind shear event is a sudden change of wind speed and/or direction over a short distance with a downwards and/or upwards movement of the air very dangerous during take off and approach phases.



WXR/PWS

U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

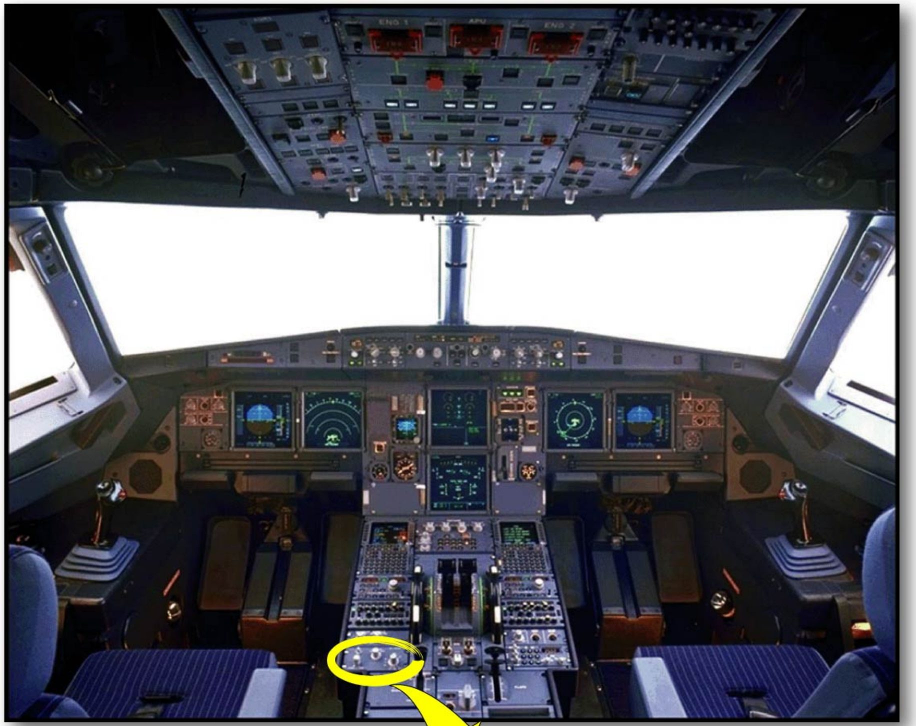
WXR/PWS (continued)

WXR/PWS PANEL

The WXR control panel is installed on the center pedestal. The information is displayed on the CAPT or F/O ND.

CAUTION: when the WXR is "ON":
- personnel should not be within 5 meters of the radome,
- no metallic obstacle should be within 5 meters,
- no refueling within 60 meters.

The multiscan is a radar function that displays all significant weather at all ranges, at all aircraft altitudes, and at all times on a display that is essentially clutter-free, without the need for pilot to input tilt or gain settings. The multiscan function optimizes weather detection and minimizes ground clutter.
The weather radar can operate in autotilt mode (automatic tilt angle): the use of the automatic tilt function is recommended in WX and TURB modes. The autotilt function uses the terrain altitude information of the EGPWS. Based on the aircraft altitude above the terrain and on terrain conditions in the area, the EGPWS determines the optimum tilt angle for the radar
Automatic tilt is selected by setting the MULTISCAN SW to AUTO on the weather radar control unit.
- switch to AUTO: Tilt setting for weather scans is automatic,
- switch to MAN: Tilt is controlled with the manual tilt control knob.



(187VU)

With Predictive Winshear (PWS) and MULTISCAN function

WXR/PWS - WXR/PWS PANEL

U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

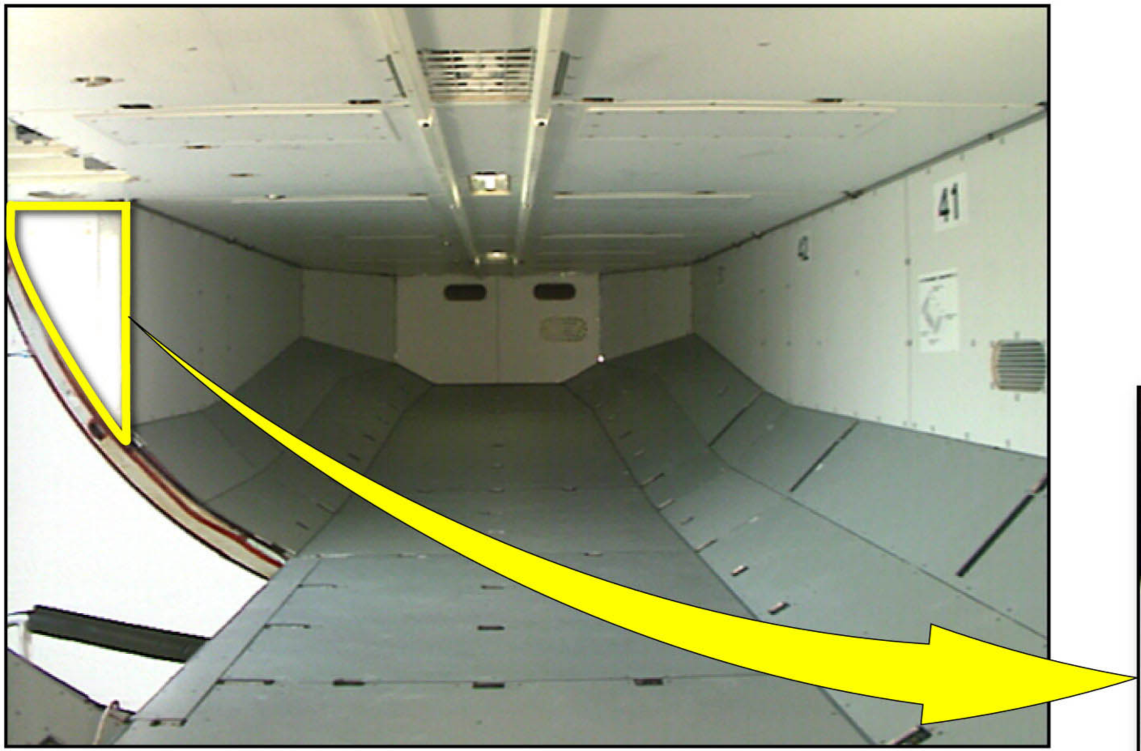
COMPONENT LOCATION

Here is the location of the:
- EGPWS computer or T2CAS computer,
- WXR computer.

The RAs are located in the aft cargo compartment.
The various antennae are located on the lower portion of the fuselage.
The WXR antenna is located in the radome.

COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM34PX000000002

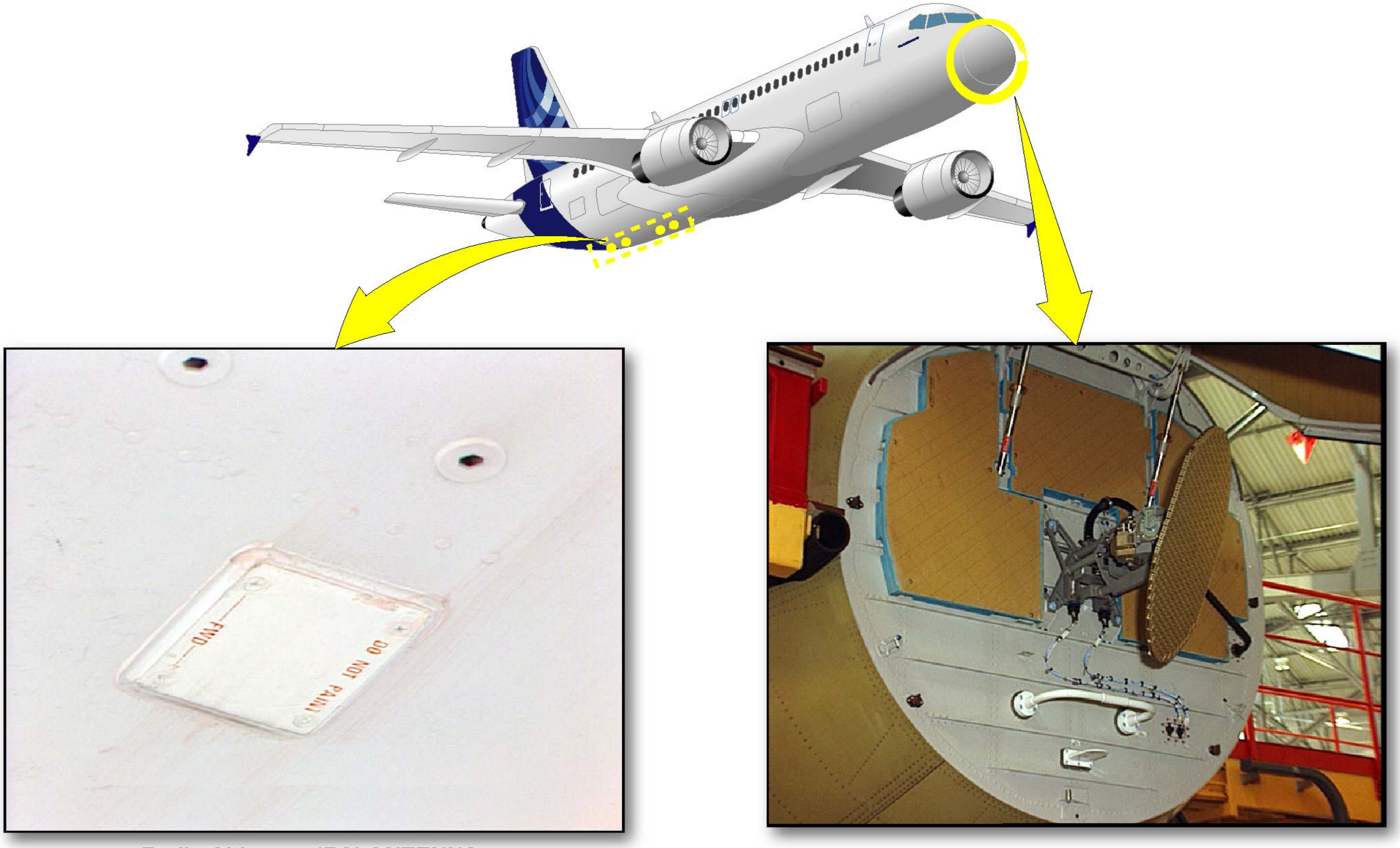


AFT CARGO COMPARTMENT

Radio Altimeter (RA) 1, 2

COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM34PX000000002



Radio Altimeter (RA) ANTENNA

Weather Radar (WXR) ANTENNA

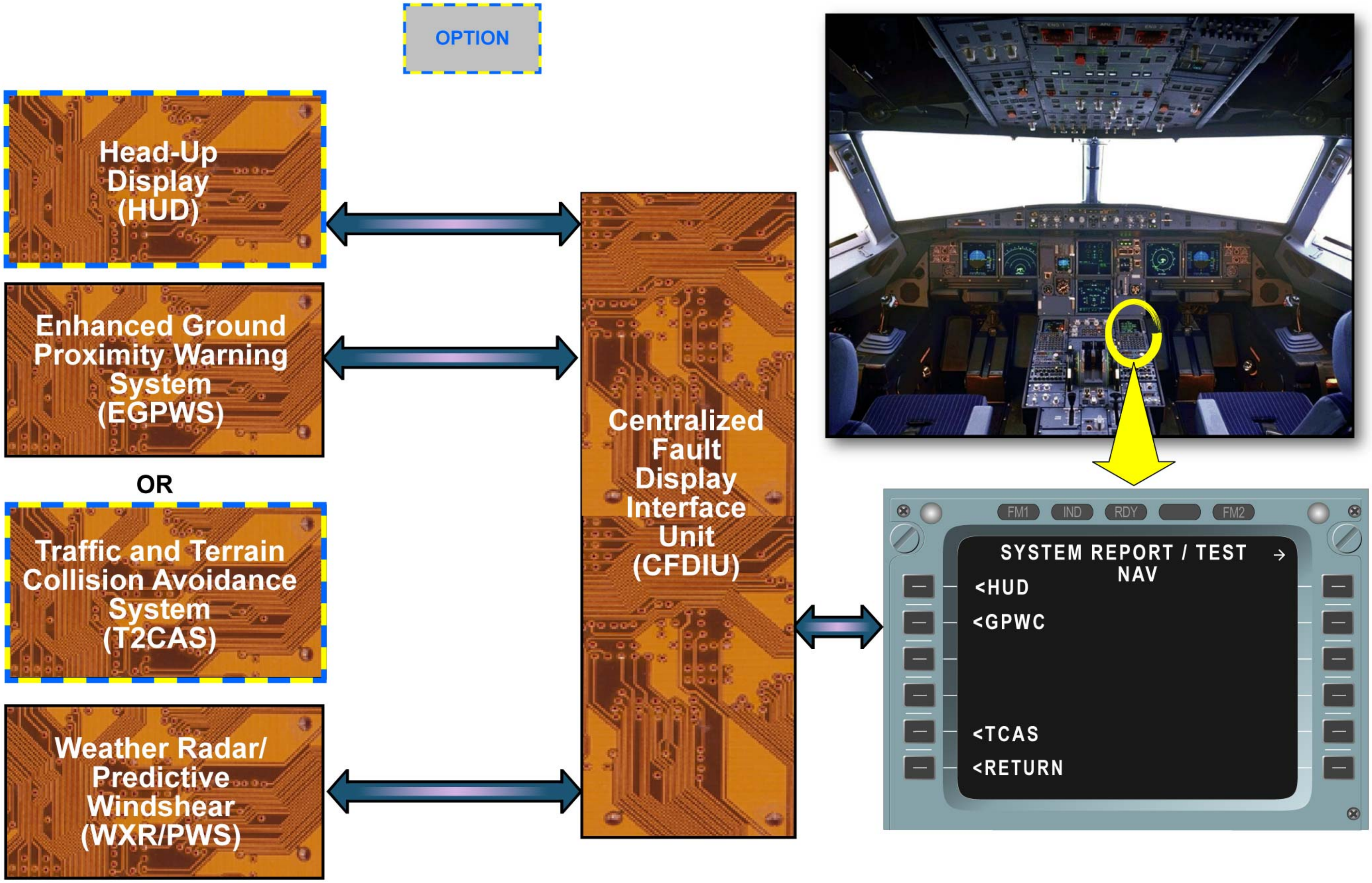
COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM34PX000000002

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

MAINTENANCE/TEST FACILITIES

All navigation systems can be tested from the MCDUs.



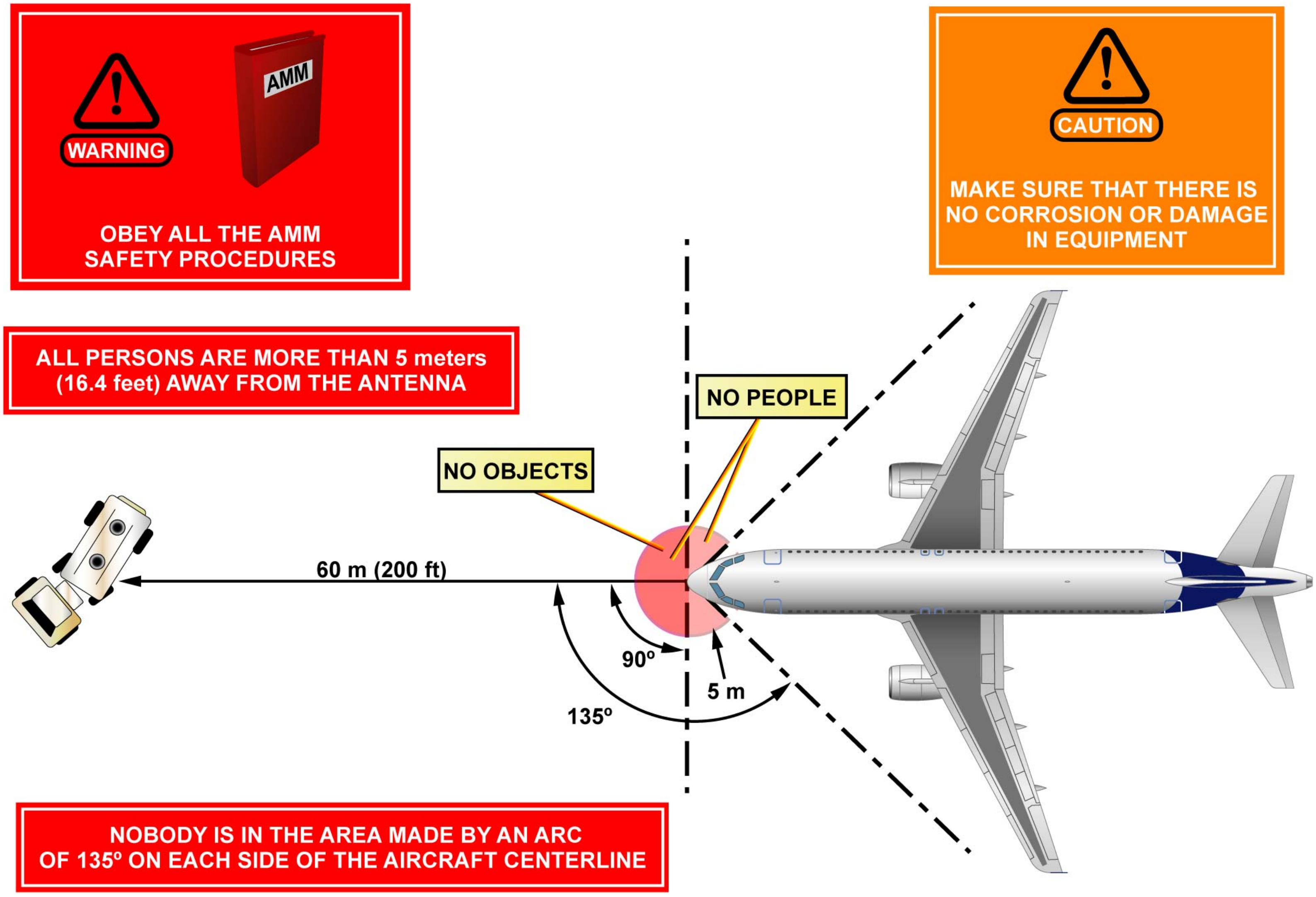
MAINTENANCE/TEST FACILITIES

34 INDEPENDENT POS DETERMINING SYS PRES. (1)

SAFETY PRECAUTIONS

When you work on A/C, make sure that you obey all the Aircraft Maintenance Manual (AMM) procedures. This will prevent injury to persons and/or damage to the A/C.
Make sure that:
- all persons are more than 5 meters (16.4 feet) away from the antenna,
- nobody is in the area made by an arc of 135 degrees on each side of the A/C centerline.

Make sure that there is no sign of corrosion or damage and no foreign objects in the test equipment.



SAFETY PRECAUTIONS

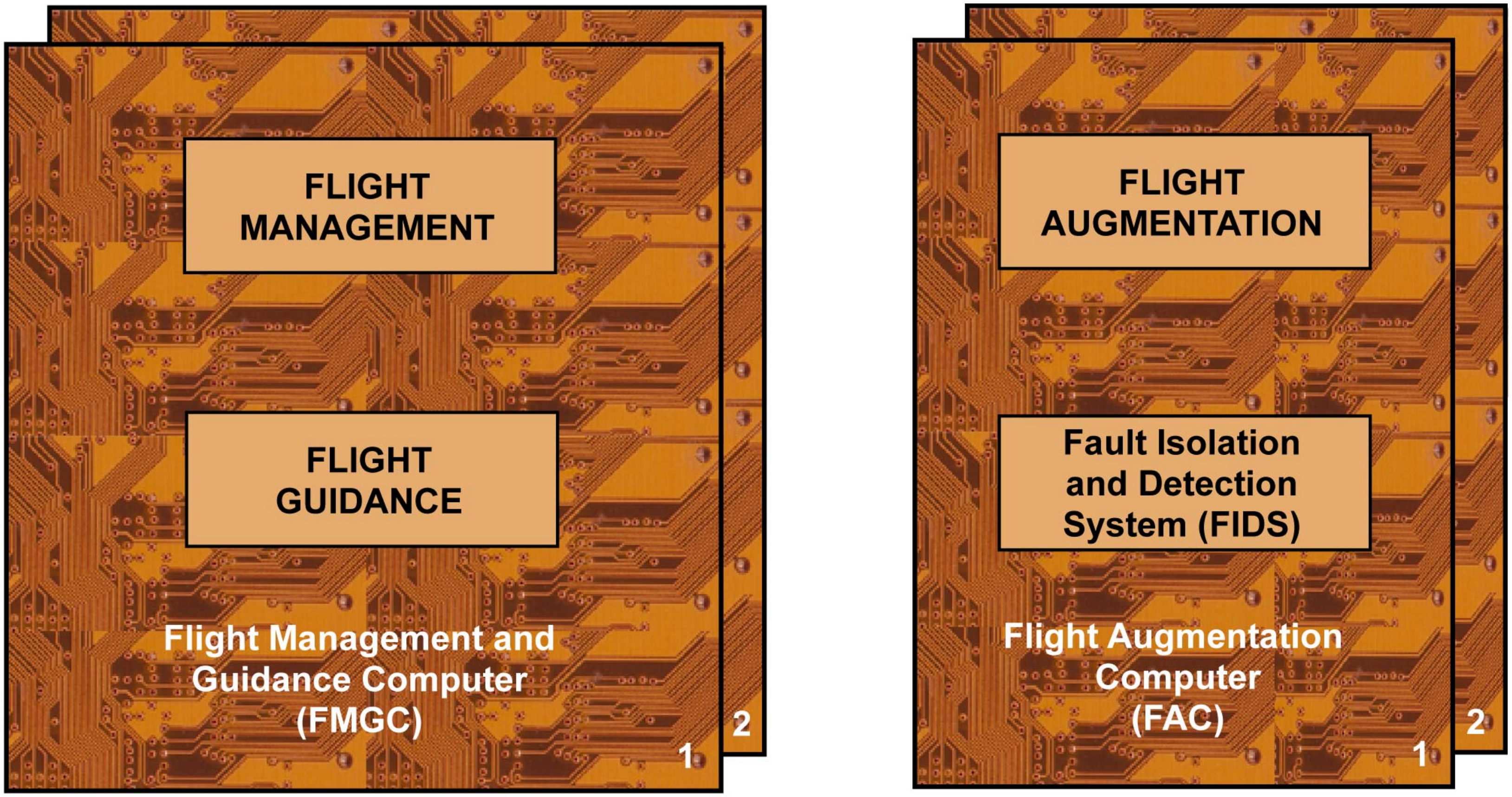
U7Z08431 - U0OT4T0 - UM34PX000000002

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

GENERAL

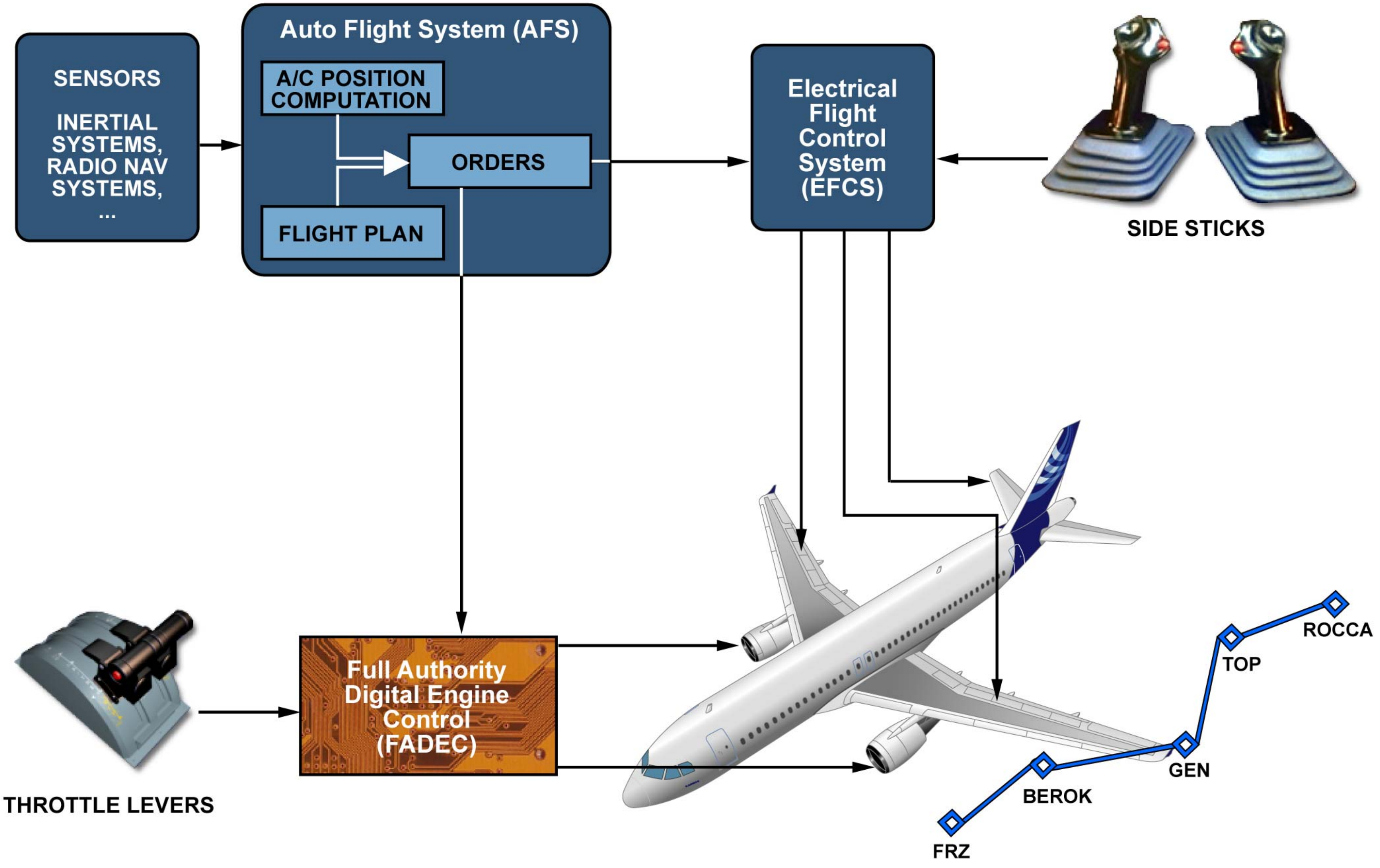
The Auto Flight System (AFS) is divided into four main parts:
- Flight Management (FM),
- Flight Guidance (FG),
- Flight Augmentation,
- Fault Isolation and Detection System (FIDS).

The first two functions are accomplished by the Flight Management and Guidance Computers (FMGCs). The other two functions are accomplished by the Flight Augmentation Computers (FACs).
The AFS calculates the position of the aircraft using several aircraft sensors.
In addition, the system has the capability of storing flight plans in its memory, which are predetermined by the airline. A flight plan describes a complete flight from departure to arrival, it includes vertical information and all intermediate waypoints. Knowing the position of the aircraft and the desired flight plan (chosen by the pilot), the AFS is able to compute the orders sent to the flight controls and engines so that the aircraft can follow the flight plan.



U7Z08431 - U0OT4T0 - UM22PZ000000001

GENERAL


SENSORS
INERTIAL SYSTEMS, RADIO NAV SYSTEMS, ...
Auto Flight System (AFS)
A/C POSITION COMPUTATION
ORDERS
FLIGHT PLAN
Electrical Flight Control System (EFCS)
SIDE STICKS
THROTTLE LEVERS
Full Authority Digital Engine Control (FADEC)
ROCCA
TOP
GEN
BEROK
FRZ

GENERAL

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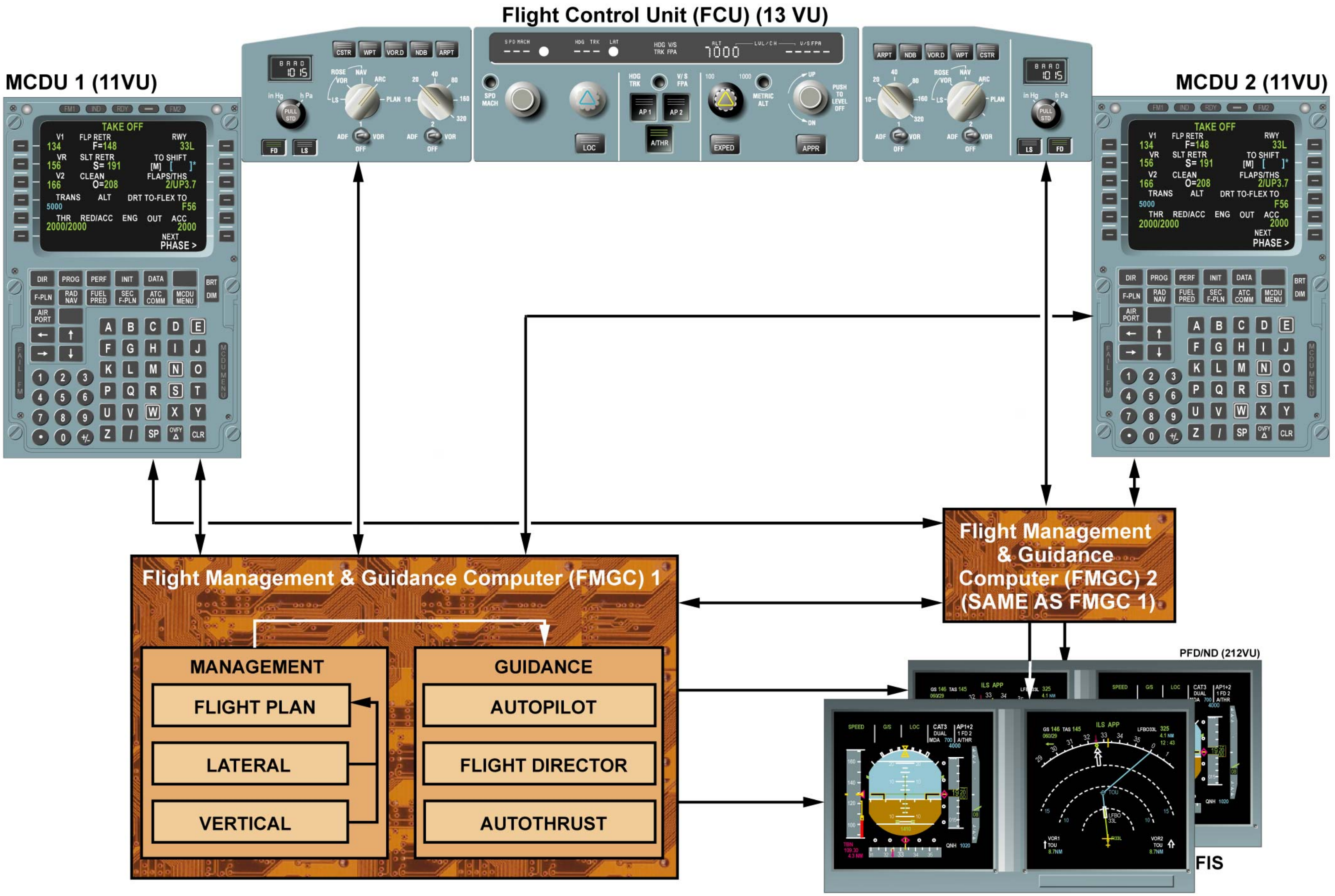
22 AUTO FLIGHT SYSTEM PRESENTATION (1)

FLIGHT MANAGEMENT/FLIGHT GUIDANCE

The FM part has several functions linked to the flight plan such as lateral and vertical guidance associated with performance computation.
The FG part has 3 functions:
- Autopilot (AP),
- Flight Director (FD),
- Autothrust (A/THR).

The FMGC functions, FM and FG are controlled from the MCDUs and the Flight Control Unit (FCU).
Basically, the MCDUs provide the long term interface between the crew and the FMGCs (e.g. flight plan selection and modification) while the FCU provides the short term interface (e.g. engagement of the autopilot, flight director and A/THR functions).
Besides the MCDUs and the FCU, the main displays presenting Flight Management and Guidance information are the EFIS displays.



FLIGHT MANAGEMENT/FLIGHT GUIDANCE

U7Z08431 - U0OT4T0 - UM22PZ000000001

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

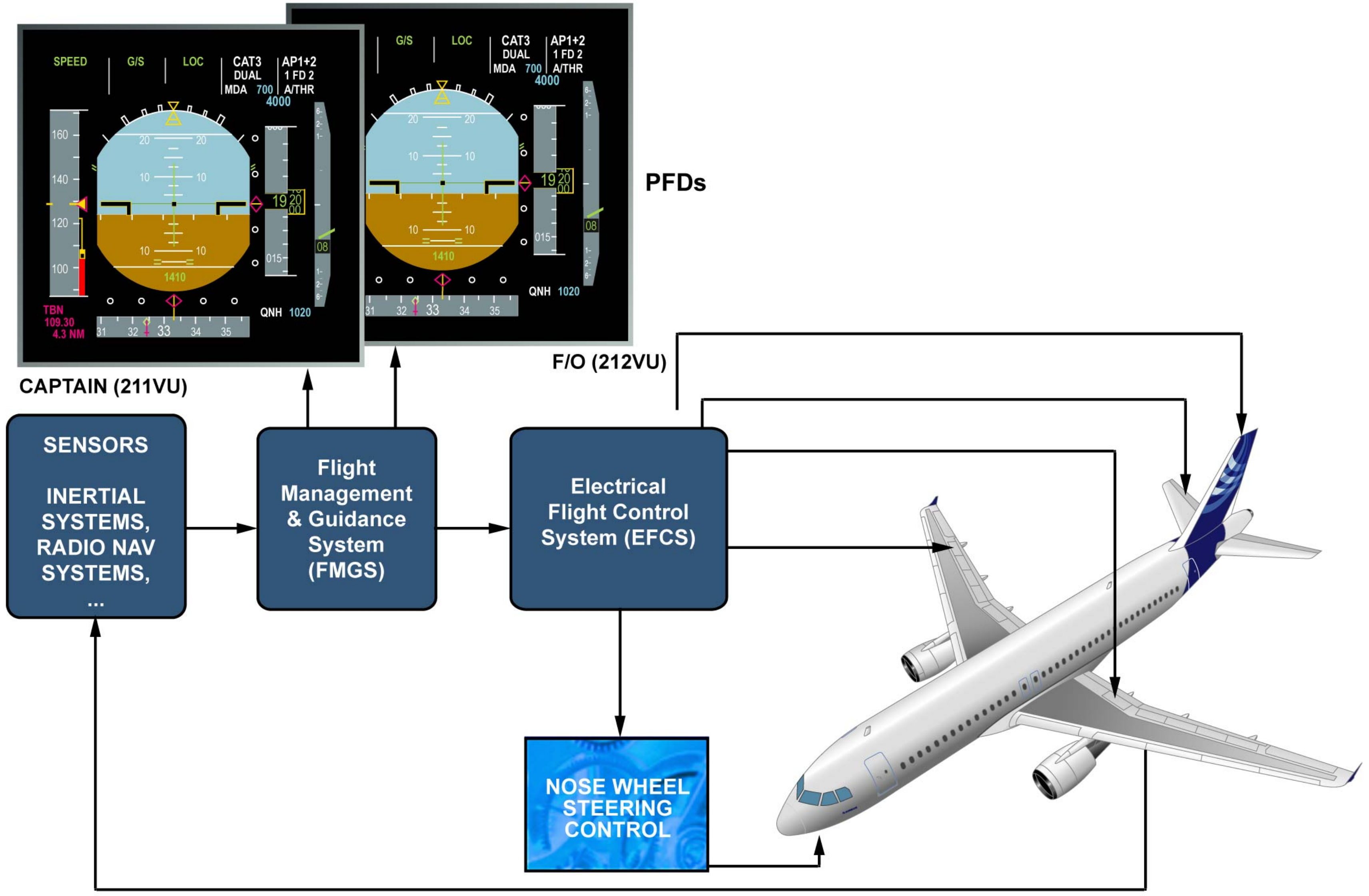
FLIGHT MANAGEMENT/FLIGHT GUIDANCE (continued)

AUTOPILOT/FLIGHT DIRECTOR

The main AP and FD functions are:
- stabilization of the aircraft around its center of gravity when the AP/FD system holds vertical speed or flight path angle and heading or track,
- acquisition and holding of a flight path,
- guidance of the aircraft after take off,
- automatic landing and go around.

The AP function gives orders to control:
- the position of the control surfaces on the three axes (pitch, roll and yaw),
- the nose wheel steering.

The FD function generates optimum guidance orders used in manual controls. The FD is also used to monitor the AP when it is engaged. The FD symbols are displayed on the PFDs.



FLIGHT MANAGEMENT/FLIGHT GUIDANCE - AUTOPILOT/FLIGHT DIRECTOR

U7Z08431 - U0OT4T0 - UM22PZ000000001

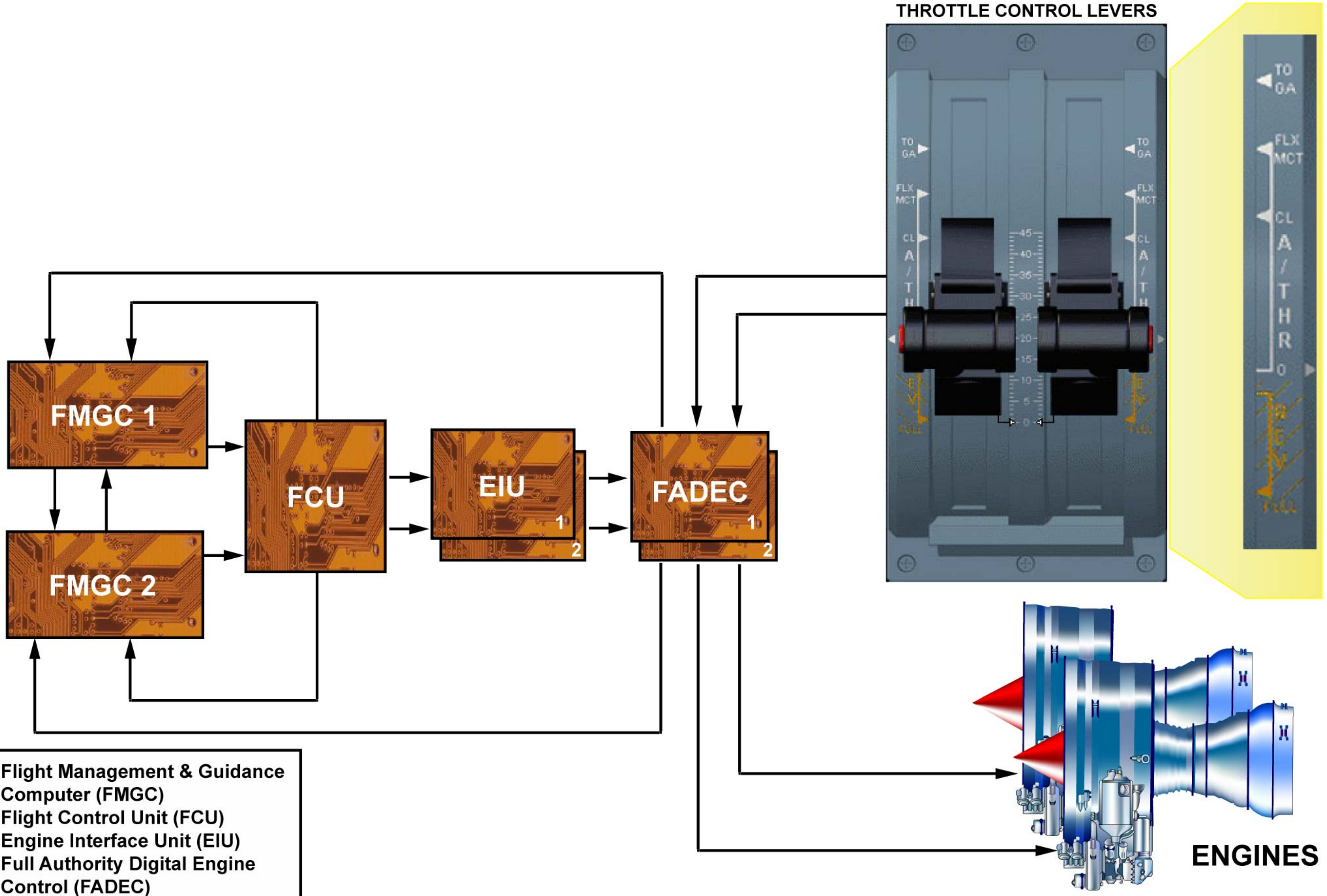
22 AUTO FLIGHT SYSTEM PRESENTATION (1)

FLIGHT MANAGEMENT/FLIGHT GUIDANCE (continued)

AUTOTHRUST

The A/THR system fulfills the following functions through the control of the thrust:
- speed or mach hold (either FMGCs computed or from throttle levers position),
- thrust hold (either FMGS computed or from throttle lever position),
- thrust reduction during descent and during flare in final approach,
- protection against insufficient speed linked to excessive angle of attack.

To fulfill the A/THR functions, the FMGCs communicate with the Full Authority Digital Engine Control (FADEC) via the FCU and the Engine Interface Units (EIUs).



Flight Management & Guidance Computer (FMGC)
Flight Control Unit (FCU)
Engine Interface Unit (EIU)
Full Authority Digital Engine Control (FADEC)

FLIGHT MANAGEMENT/FLIGHT GUIDANCE - AUTOTHRUST

U7Z08431 - U0OT4T0 - UM22PZ000000001

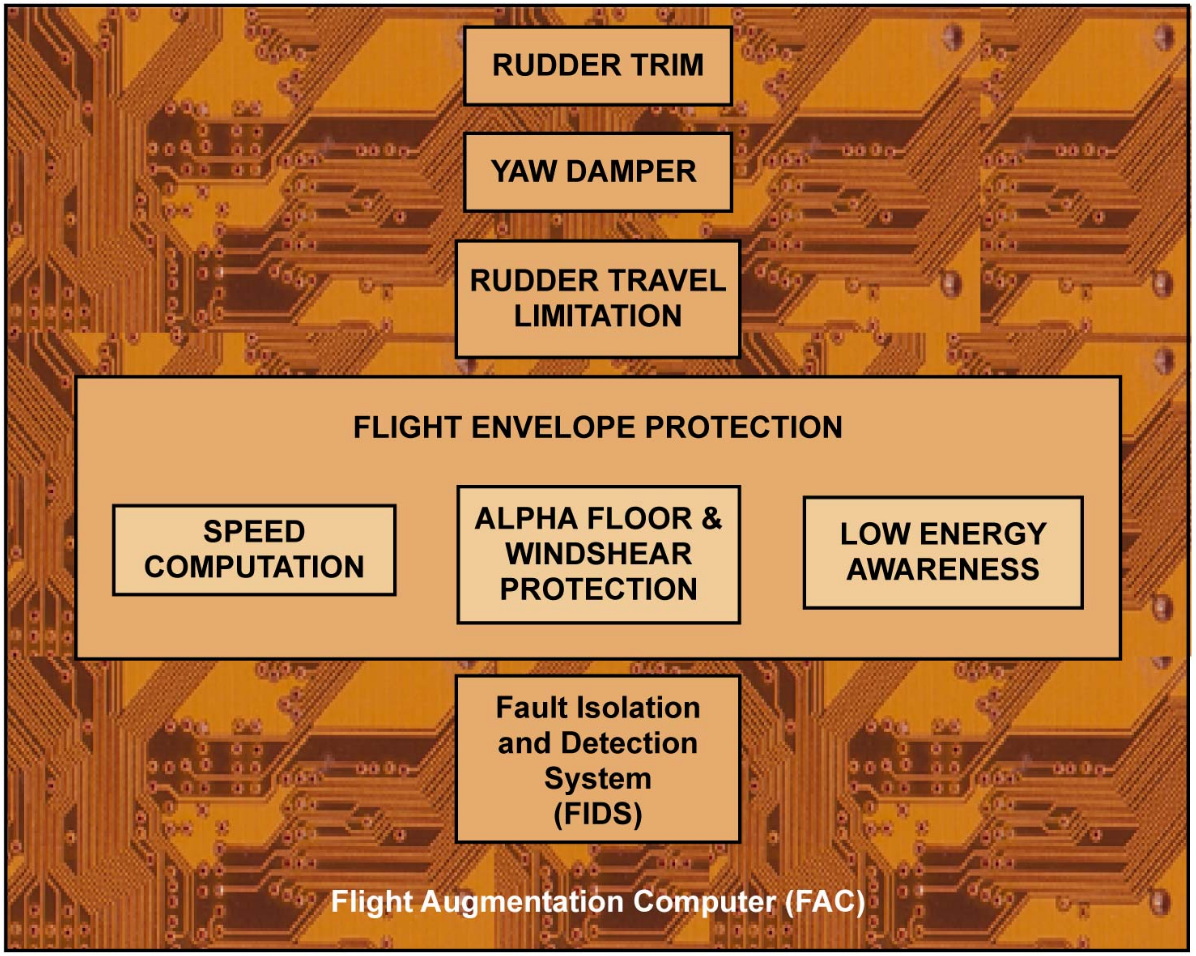
22 AUTO FLIGHT SYSTEM PRESENTATION (1)

FLIGHT AUGMENTATION

The flight augmentation part fulfills the following functions:
- rudder trim,
- yaw damper,
- rudder travel limitation,
- flight envelope protection,
- FIDS.

For flight envelope protection, the FAC computes:
- the various speeds for aircraft operation (e.g. flaps limit speed),
- the excessive angle of attack and windshear detection,
- the low energy warning, indicating to the crew that the aircraft is quickly decelerating and that thrust will have to be increased to recover a positive flight path angle through pitch control.

The FIDS function is only active in FAC 1. FAC 1 is connected to the BITE of all the AFS computers and communicates to the Centralized Fault Display System (CFDS).



FLIGHT AUGMENTATION

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING

The different panels used for AFS control and indicating are described in this topic.

MCDUs

Two MCDUs are located on the center pedestal.
The MCDU is the primary entry/display interface between the pilot and the FM part of the FMGC.
The MCDUs exchange information not directly but via the FMGCs.

PANEL LOCATION/CONTROL AND INDICATING - MCDUS

U7Z08431 - U0OT4T0 - UM22PZ000000001

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

FLIGHT CONTROL UNIT

A FCU is installed on the glareshield.
The FCU front face includes an AFS control panel between two EFIS control panels.
The AFS control panel allows and displays the AP and A/THR engagement, and the selection of guidance modes and flight parameters.
Each pilot has an EFIS control panel to select the display on his related EFIS screens.
Speed, lateral guidance and level change can be selected by the pilot after a "pull" action or managed by the flight management after a "push" action. In that case, the parameter window shows dashes (- - - -) and a white dot will indicate that the reference is managed.
An exception to this rule is when the V/S - FPA knob is pushed, a level off is immediately commanded.

PANEL LOCATION/CONTROL AND INDICATING - FLIGHT CONTROL UNIT

U7Z08431 - U0OT4T0 - UM22PZ000000001

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

EFIS DISPLAYS

Four EFIS displays, i.e. two PFDs and two NDs, are located on the main instrument panel.
Flight parameters are displayed on the PFDs while the flight plan and navigation data are displayed on the NDs.

PANEL LOCATION/CONTROL AND INDICATING - EFIS DISPLAYS

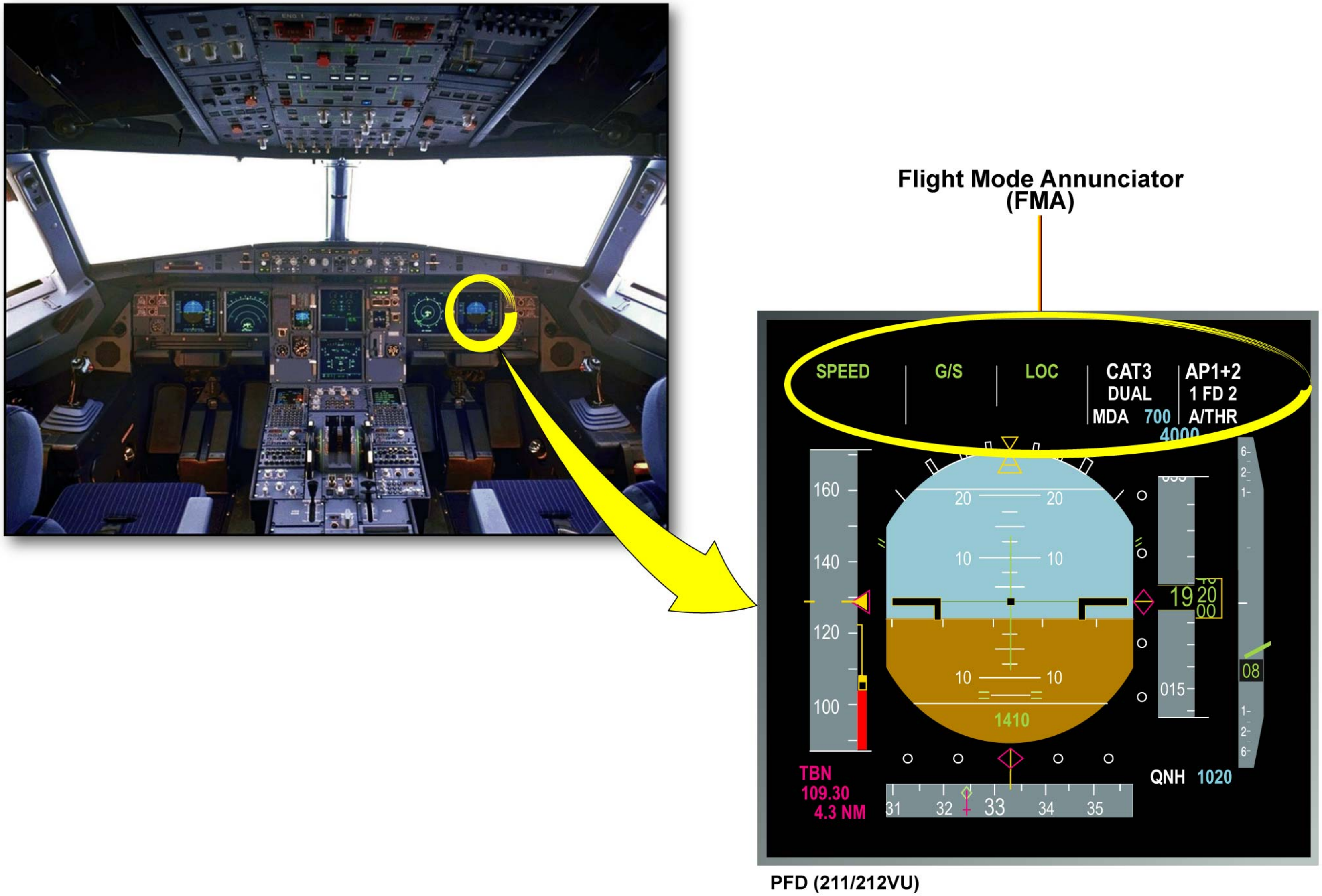
22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

PRIMARY FLIGHT DISPLAY

As the main guidance instrument, the PFD displays various speeds and reference parameters used for short term flight guidance.
The Flight Mode Annunciator (FMA) is the top part of the PFD and indicates:
- the AP, FD and A/THR engagement status,
- the AP/FD and A/THR modes,
- the landing category.

U7Z08431 - U0OT4T0 - UM22PZ000000001



PANEL LOCATION/CONTROL AND INDICATING - PRIMARY FLIGHT DISPLAY

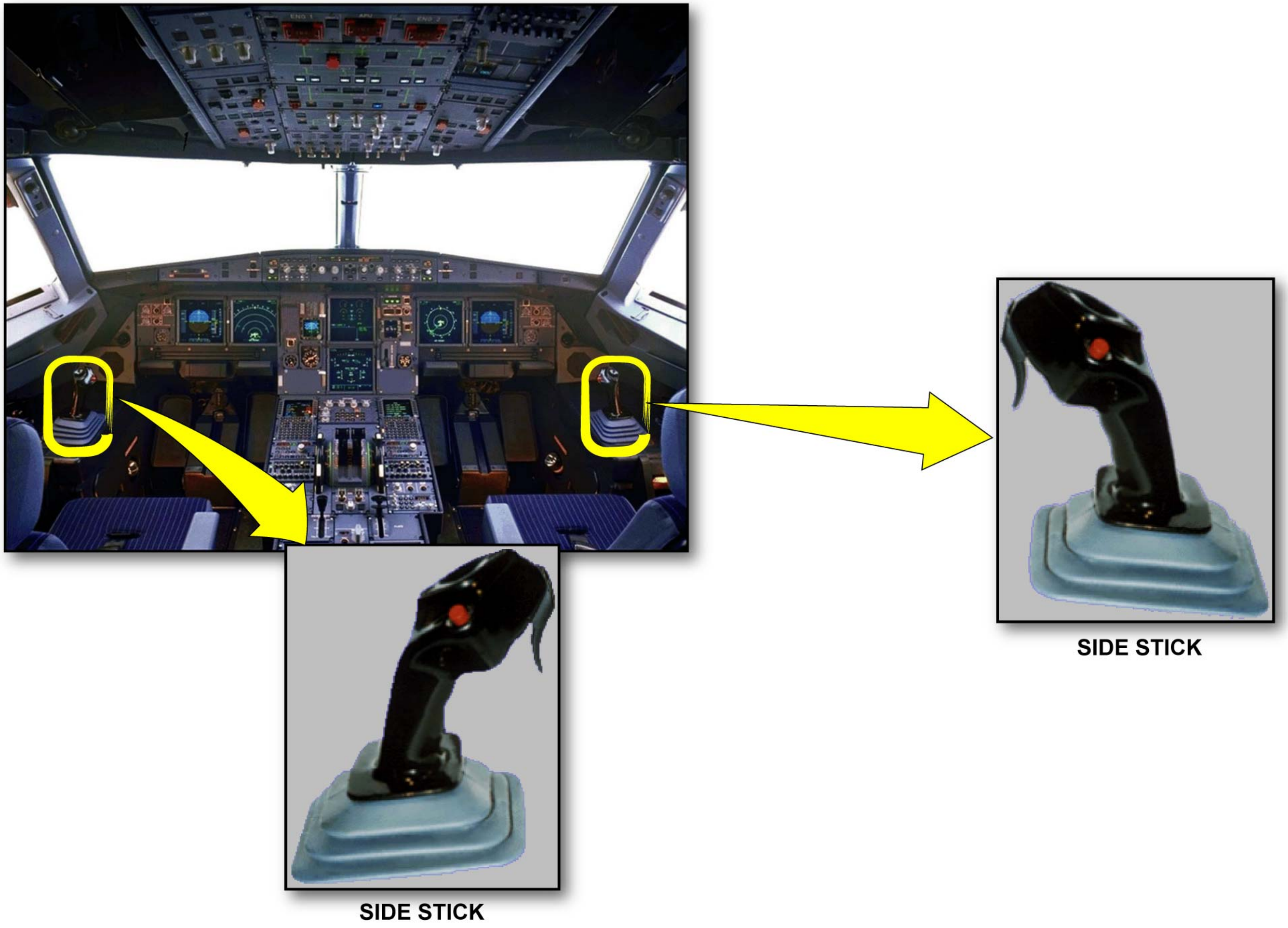
U7Z08431 - U0OT4T0 - UM22PZ000000001

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

SIDE STICKS

Two side sticks are respectively located on the CAPT lateral panel and F/O lateral panel.
When the AP is engaged, the side sticks are locked in the neutral position, by solenoids.
The AP is disengaged, and the side sticks become free, when the red TAKEOVER & PRIORITY pushbutton on any side stick is pressed or when a force above a certain threshold is applied on any side stick.



PANEL LOCATION/CONTROL AND INDICATING - SIDE STICKS

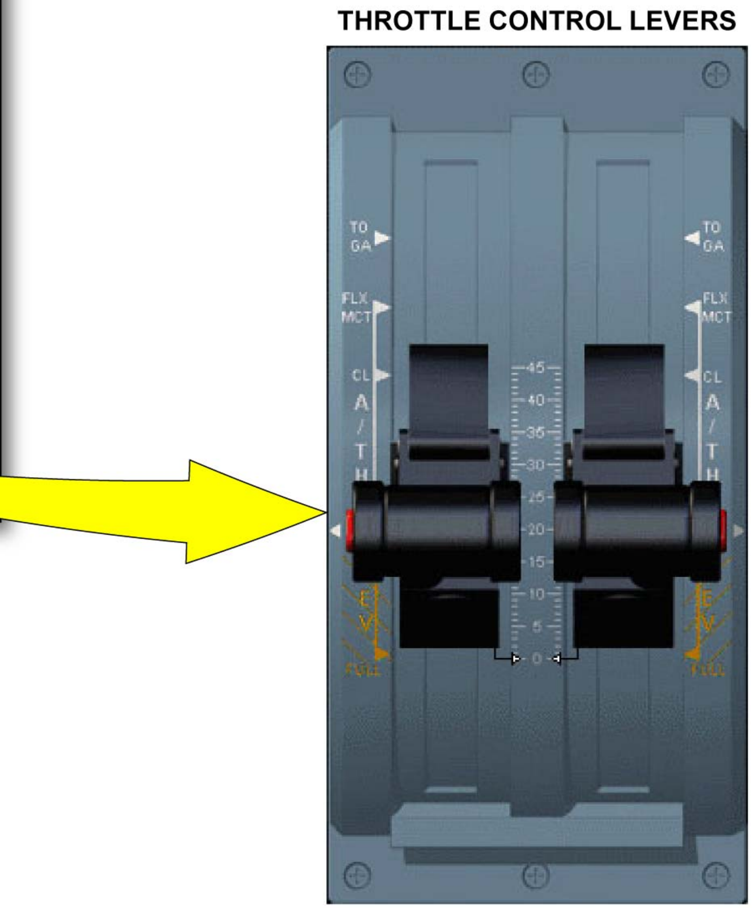
22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

THROTTLE LEVERS

The engines are manually controlled by throttle levers, which are located on the center pedestal, or automatically controlled by the A/THR system. Two red INSTINCTIVE DISCONNECT pushbuttons, located on the throttle levers, allow the A/THR function to be disengaged (push either one). Note that the throttle levers never move automatically.

U7Z08431 - U0OT4T0 - UM22PZ000000001



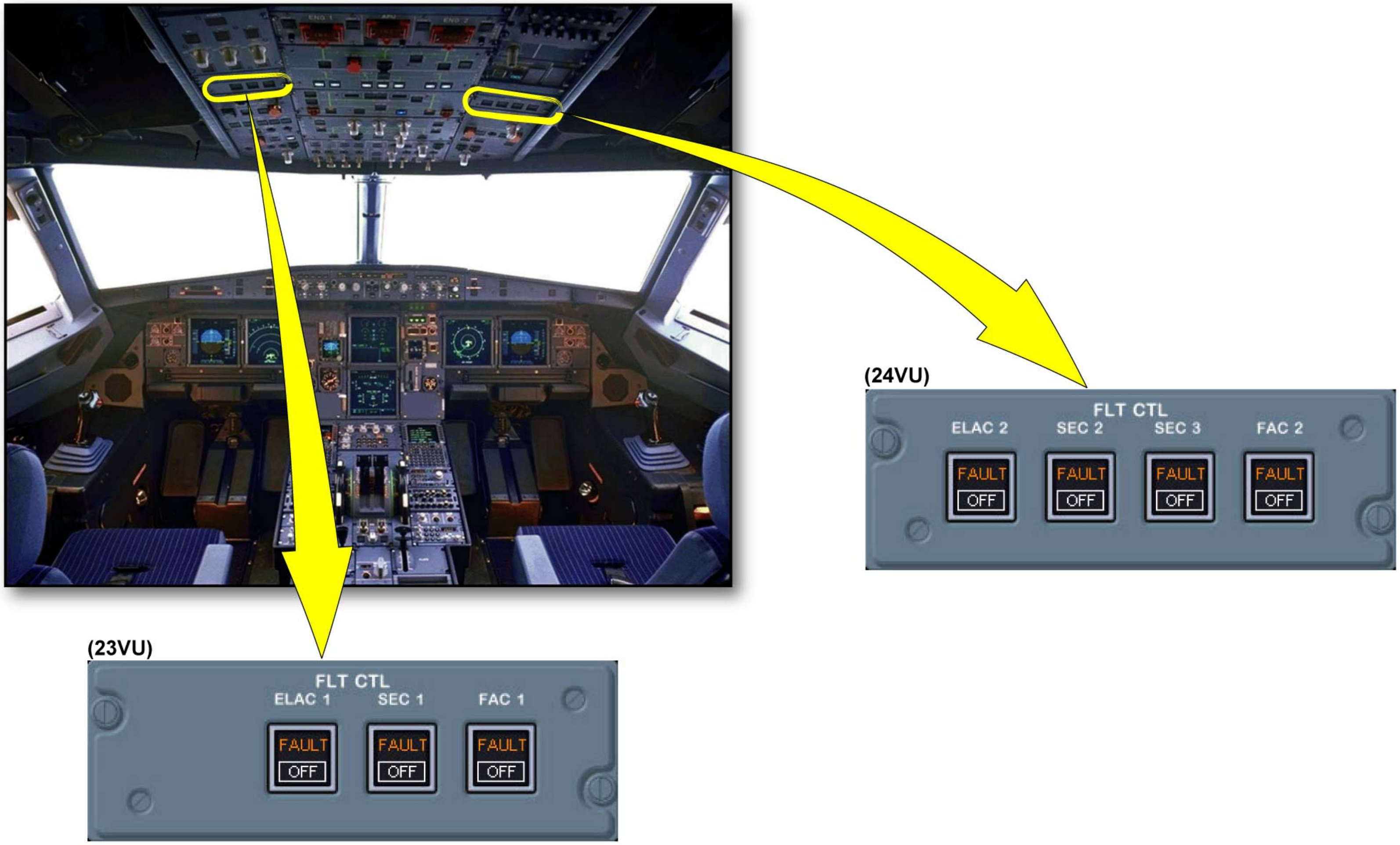
PANEL LOCATION/CONTROL AND INDICATING - THROTTLE LEVERS

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

FLIGHT CONTROL PANELS

On the two flight control (FLT CTL) panels, located on the overhead panel, there is a pushbutton to respectively disengage FAC 1 and 2.



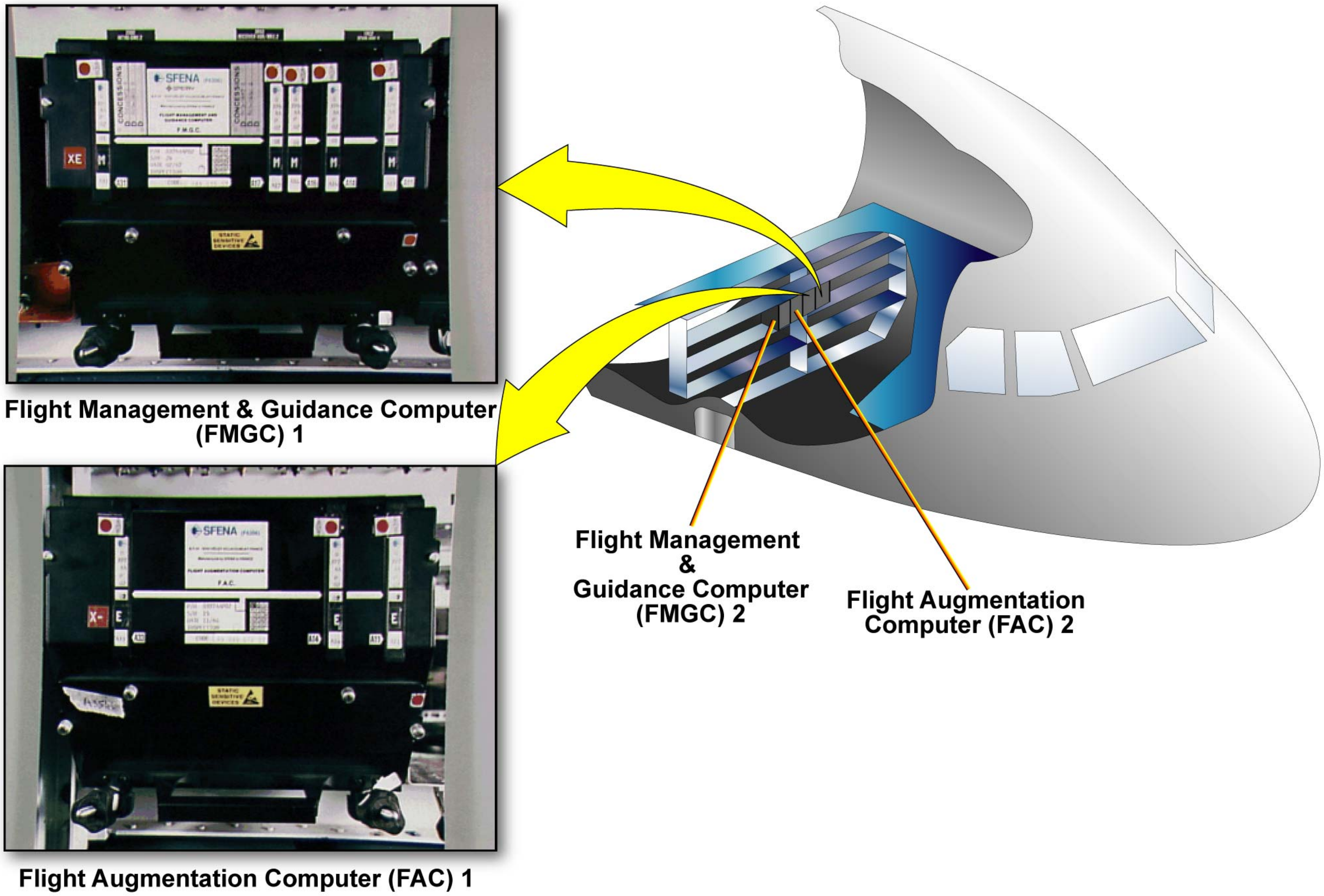
U7Z08431 - U0OT4T0 - UM22PZ000000001

PANEL LOCATION/CONTROL AND INDICATING - FLIGHT CONTROL PANELS

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

COMPONENT LOCATION

The AFS computers are located in the aft avionics rack (80VU).



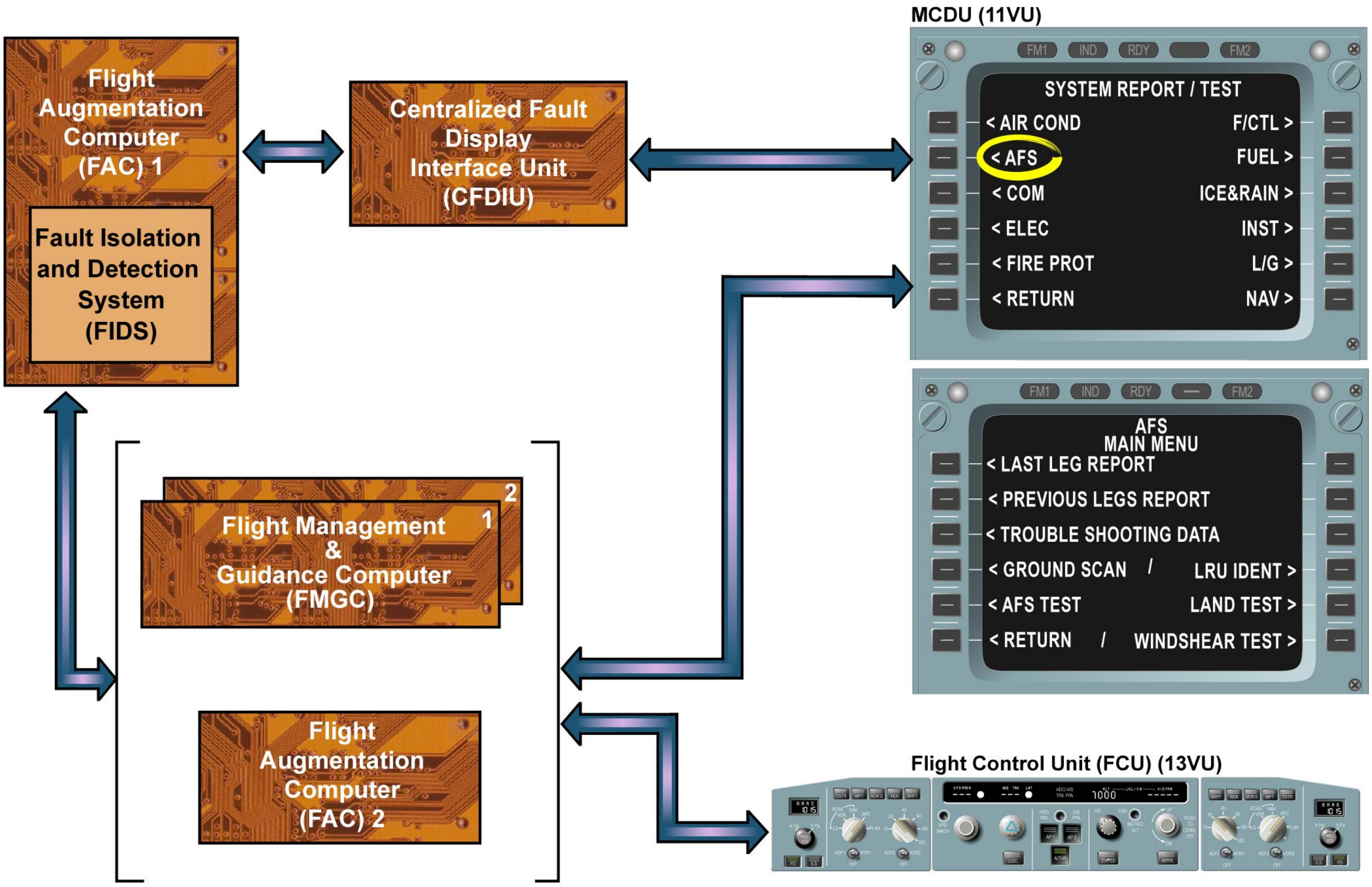
COMPONENT LOCATION

U7Z08431 - U0OT4T0 - UM22PZ000000001

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

Using the MCDU, you can have access to the CFDS fault messages of the AFS.
The BITE of each AFS computer including FCU and MCDUs, can be interrogated via the FAC 1. AFS TEST and LAND TEST can be launched from the MCDUs.



MAINTENANCE/TEST FACILITIES

22 AUTO FLIGHT SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

Make sure that all circuits in maintenance are isolated before you apply electrical power to the aircraft.
Before you pressurize/depressurize a hydraulic system:
- make sure that the travel ranges of the flight control surfaces are clear,
- check that the Flap/Slat lever agrees with the actual flap and slat surface position,
- make sure that the Speed brake Selector is retracted and disarmed.

Put safety devices and warning notices before you start a task on or near:
- the flight controls,
- the flight control surfaces,
- the landing gear and the related doors,
- components that move.

Put warning notices in the cockpit to identify systems undergoing maintenance work.

SAFETY PRECAUTIONS

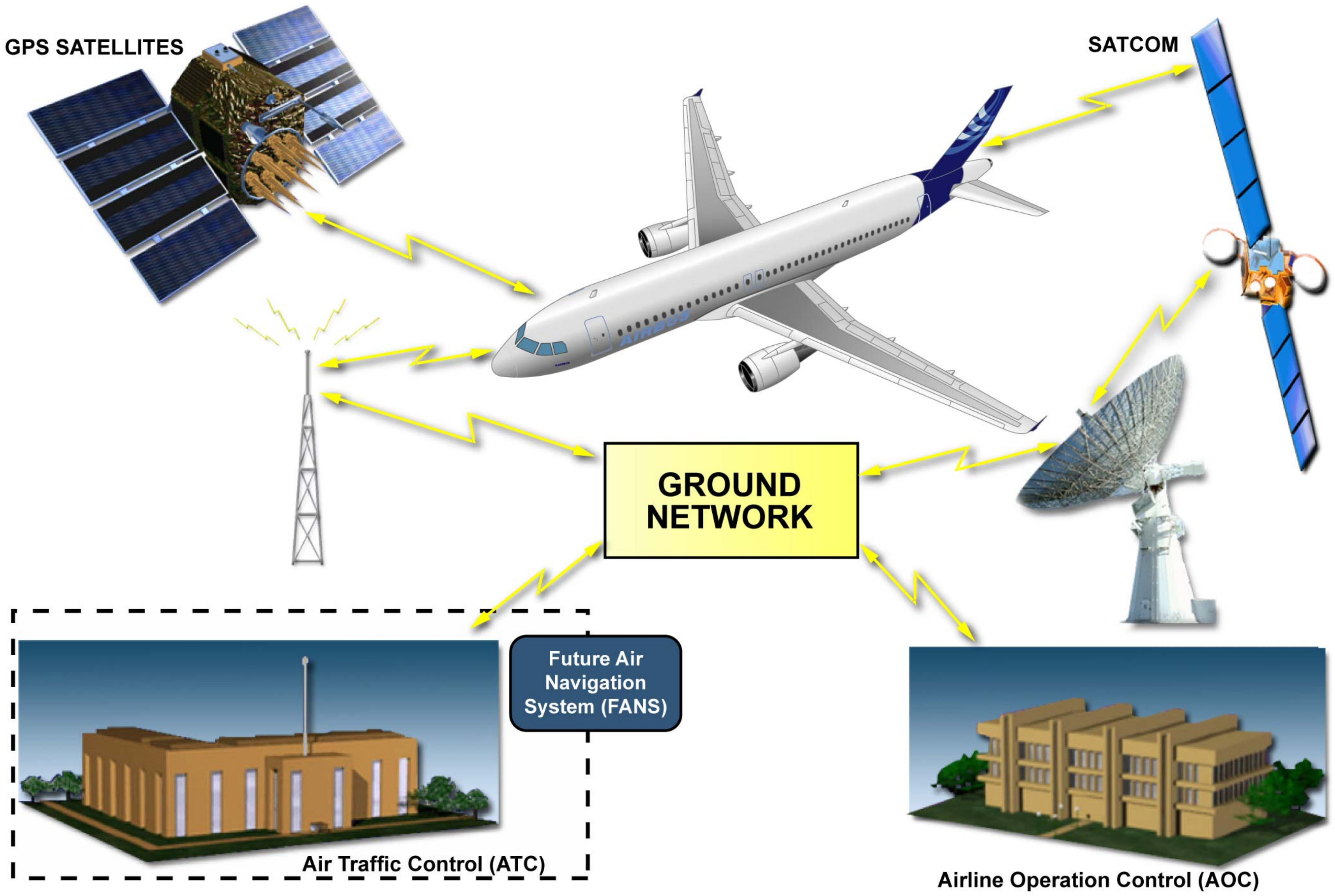
U7Z08431 - U0OT4T0 - UM22PZ000000001

46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

GENERAL

The Air Traffic Information Management System (ATIMS) complies with the future developments of the Communication, Navigation, Surveillance and Air Traffic Management (ATM) also known as Future Air Navigation System (FANS). It covers the evolution of the way the airspace will be used in the years to come.
It will be used in different operational environments and is designed to be easily configured to the airlines needs.
ATIMS enables data-link communication: VHF Data Radio (VDR), HF Data Radio (HFDR) and SATCOM (if installed) and the exchange of complex data or specific reports between the aircraft and the ground centers:
- controller pilot data-link communications (HF voice in backup) for air traffic management,
- automatic reporting (position, intention) for air traffic surveillance,
- specific airline/aircraft communications (operational control) to improve airline operational costs and flexibility.

Standard AOC functionalities are basically provided but airlines can customize these functions and the way they are accessed by the crew.
On the ground, the different existing networks dispatch the messages. These networks are operated by private companies such as ARINC, SITA and others, which are known as service providers.



GENERAL

U7Z08431 - U0OT4T0 - UM46PZ000000001

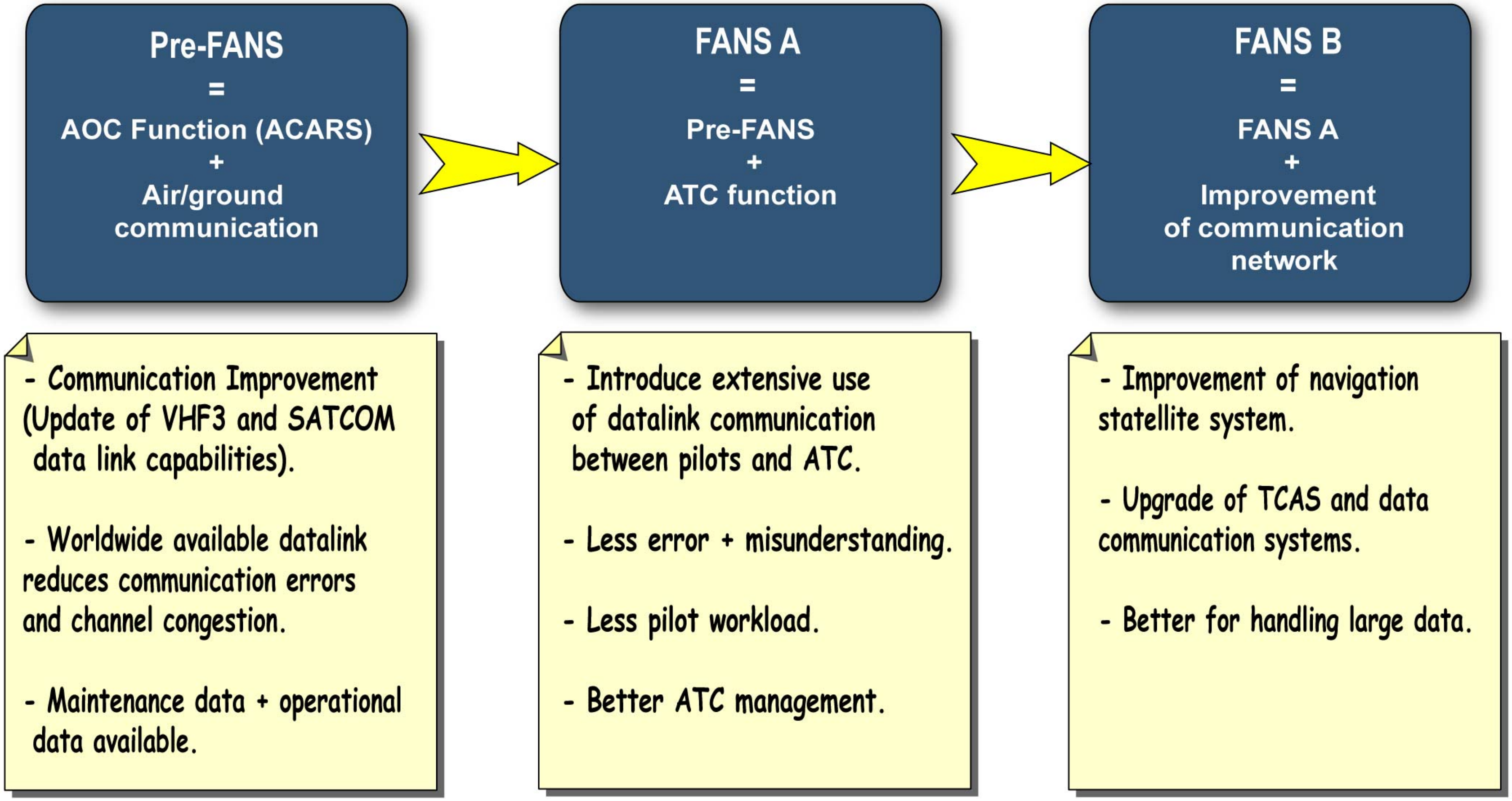
46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

GENERAL (continued)

PRE-FANS, FANS

There are three stages of FANS development.
- Pre-FANS (Communications (COM) and AOC functions),
- FANS A (pre-FANS + ATC functions) and
- FANS B (FANS A + improved ground network + Traffic Alert and Collision Avoidance System (TCAS)).

Today, the pre-FANS allow the AOC function.
It provides the crew with Aircraft Communication Addressing and Reporting System (ACARS) equivalent functions and more, as for instance:
- NOtice To AirMen (NOTAM), weather, winds aloft requests,
- free text message exchanges,
- diversion, delay, refueling, flight reports,
- aircraft data from Centralized Fault Display System (CFDS), Aircraft Integrated Data System (AIDS), cabin terminal...etc.



ACARS: Aircraft Communication Adressing and Reporting System
AOC: Airline Operation Center
ATC: Air Traffic Control
FANS: Future Air Navigation System

GENERAL - PRE-FANS, FANS

46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

ARCHITECTURE

The ATIMS pre-FANS configuration mainly has an Air Traffic Service Unit (ATSU).
The ATSU is used:
- to manage communications (air/ground data-links),
- to manage applications (on board data routing).

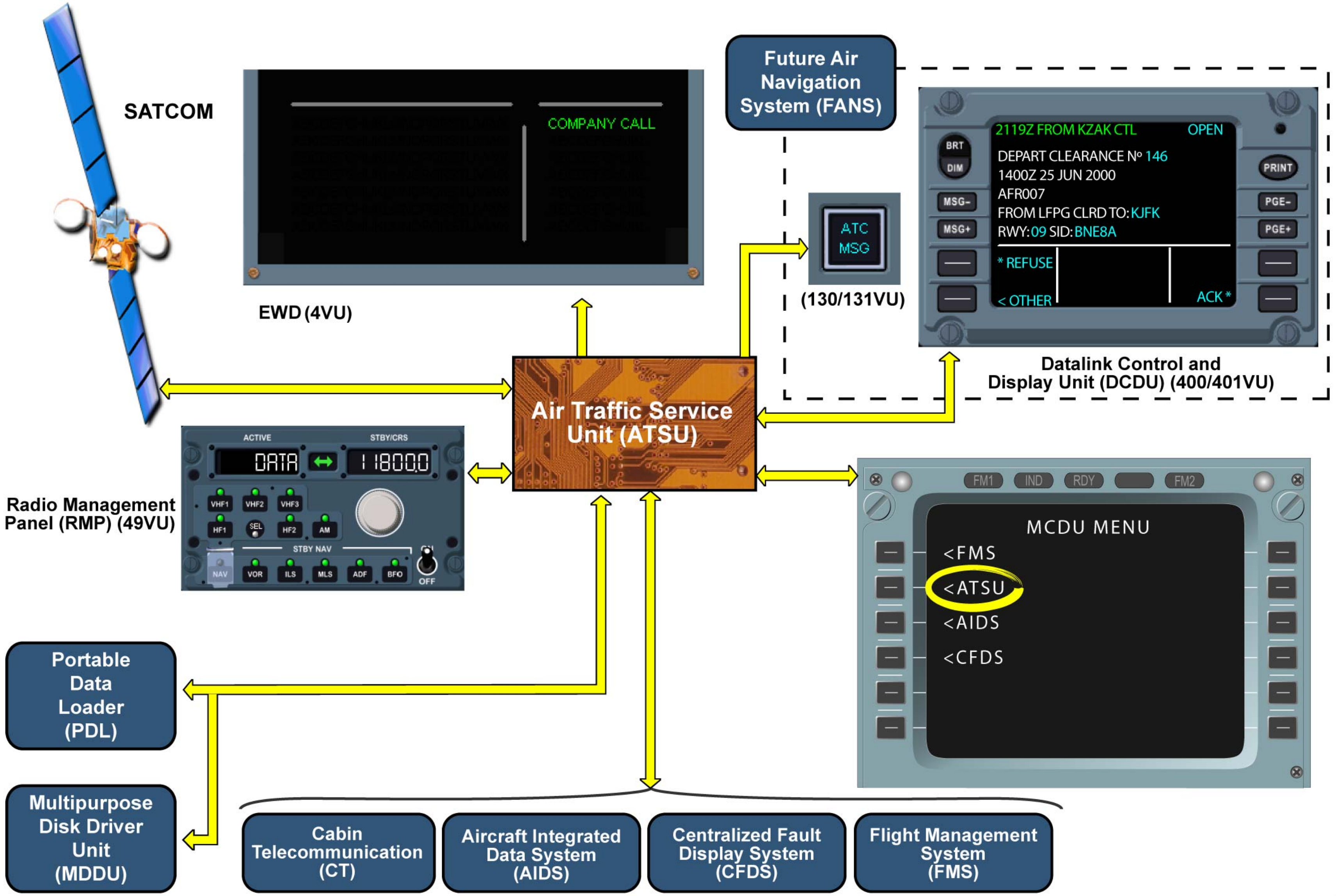
The ATSU is configured in pre-FANS to do:
- the management of air/ground communication,
- Airline Operational Control applications.

The communication devices include:
- the SATCOM, if installed,
- the VDR
- the HF.

The Pre FANS crew interfaces include:
- the ECAM, and,
- the MCDU.

For FANS-A and FANS-B equipped aircraft there are:
- two Data Communication Display Units (DCDUs),
- two attention getter pushbuttons, marked "ATC MSG",
- the MCDU "ATC COM" key operative.

The ATSU manages the communication message exchanges to and from the peripheral computers (on-board routing function).
The software is uploaded in the ATSU by means of the Multipurpose Disk Driver Unit (MDDU) or the Portable Data Loader (PDL).



ARCHITECTURE

U7Z08431 - U0OT4T0 - UM46PZ000000001

46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

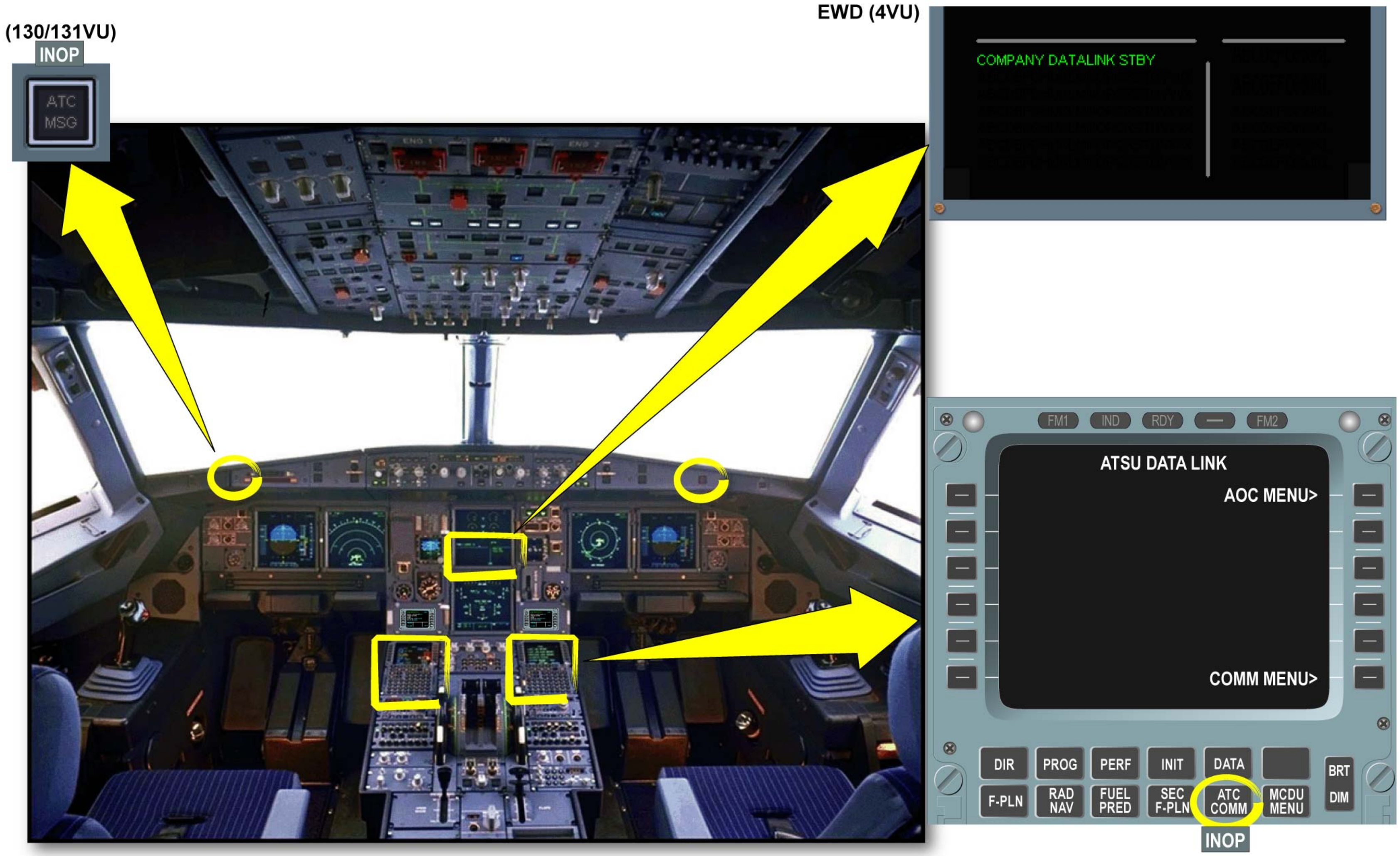
PANEL LOCATION/CONTROL AND INDICATING

We will now have a look at the control and indicating of the system.

PRE-FANS

The ATSU line key from the MCDU MENU gives access to:
- AOC MENU line key and,
- COMM line key.

MCDU "ATC COM" key is inoperative.
The COMM line key gives access to the COMM MENU, which is used for the management and control of the air/ground router.
The AOC line key gives access to the AOC MENU page, which is used for the management of AOC functions (equivalent to ACARS functions).
The content of this menu depends on the AOC applications selected by the airline.
Messages related to the pre-FANS status are displayed on the EWD.
The "ATC MSG" pushbutton is inoperative.



PANEL LOCATION/CONTROL AND INDICATING - PRE-FANS

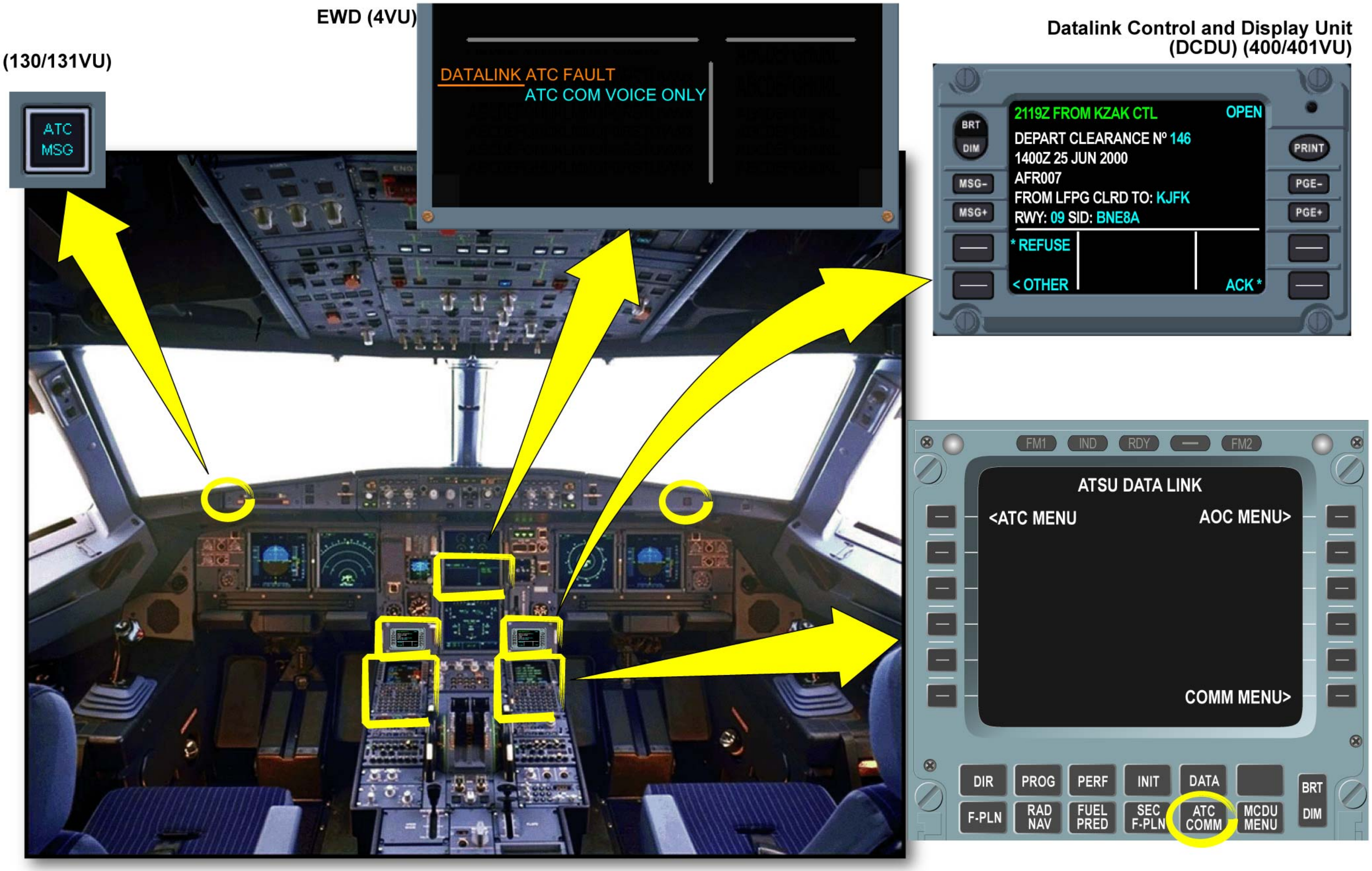
46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

FANS

In FANS configuration the "ATC MENU" prompt is available to get access to ATC pages. The "ATC COMM" key gives the same access but as a shortcut.
Two attention getter pushbuttons are operative and indicate ATC incoming messages.
Two DCDUs give full time accessibility and readability for messages exchanged with the ATC and both crew, which require only limited head-down time.
Text messages instead of voice communication reduce the risk of misunderstanding.

NOTE: Note: The DCDUs are the interfaces for ATC messages only.



PANEL LOCATION/CONTROL AND INDICATING - FANS

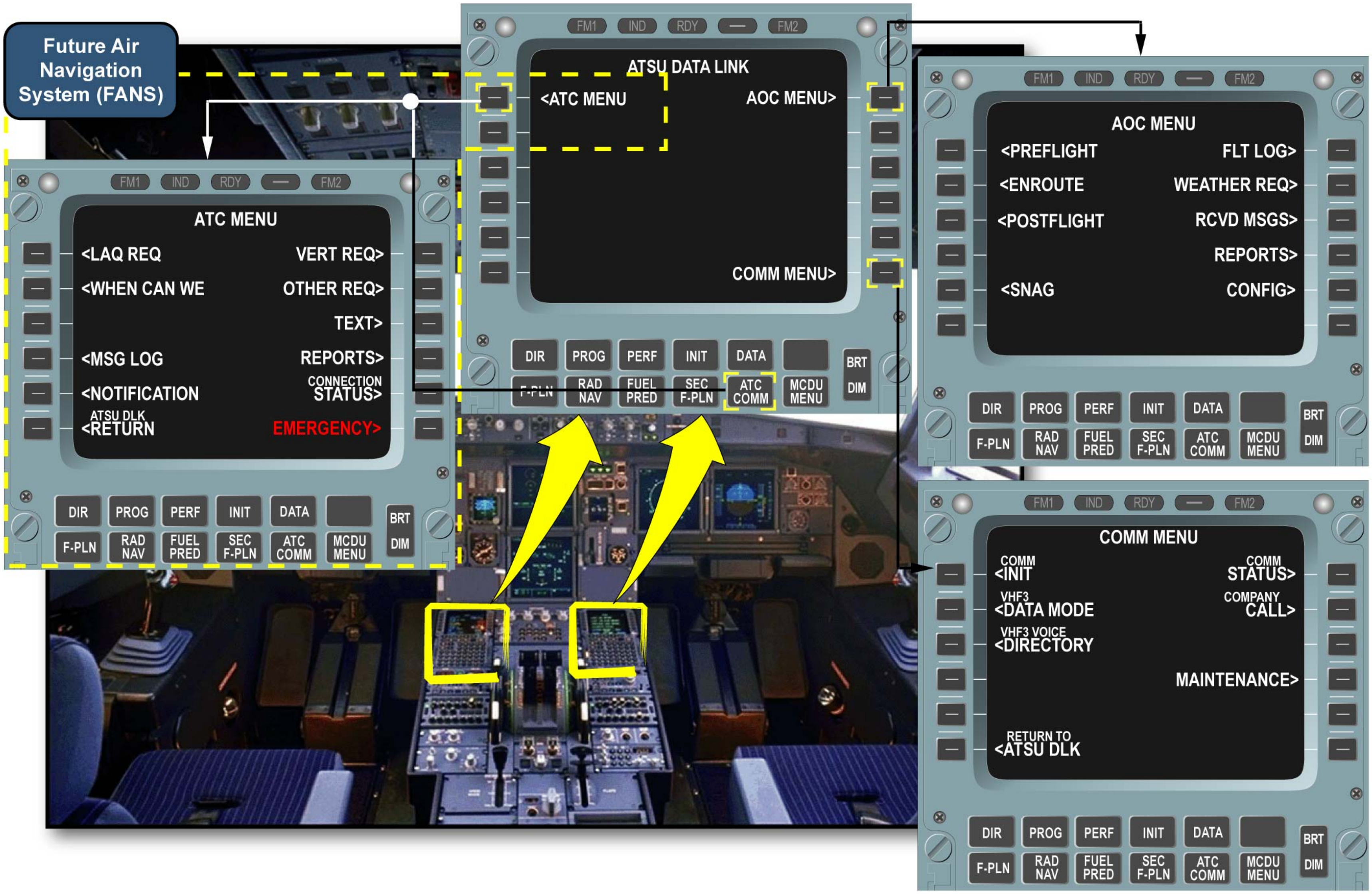
46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

PANEL LOCATION/CONTROL AND INDICATING (continued)

MCDU MENU

The COMM MENU is used for communication settings, as selection of the Service provider and frequency.
The AOC MENU line key gives access to the AOC MENU which is equivalent to ACARS functions.
The content of this menu depends on the AOC applications selected by the airline.
The ATC MENU gives access to the least frequent ATC operations, which are:
- data entry for message preparation,
- access to previously exchanged messages (MSG LOG).

Note that the ATC COMM key has the same functions as ATC MENU but provides quick access to the page whatever the MCDU menus displayed.



PANEL LOCATION/CONTROL AND INDICATING - MCDU MENU

U7Z08431 - U0OT4T0 - UM46PZ000000001

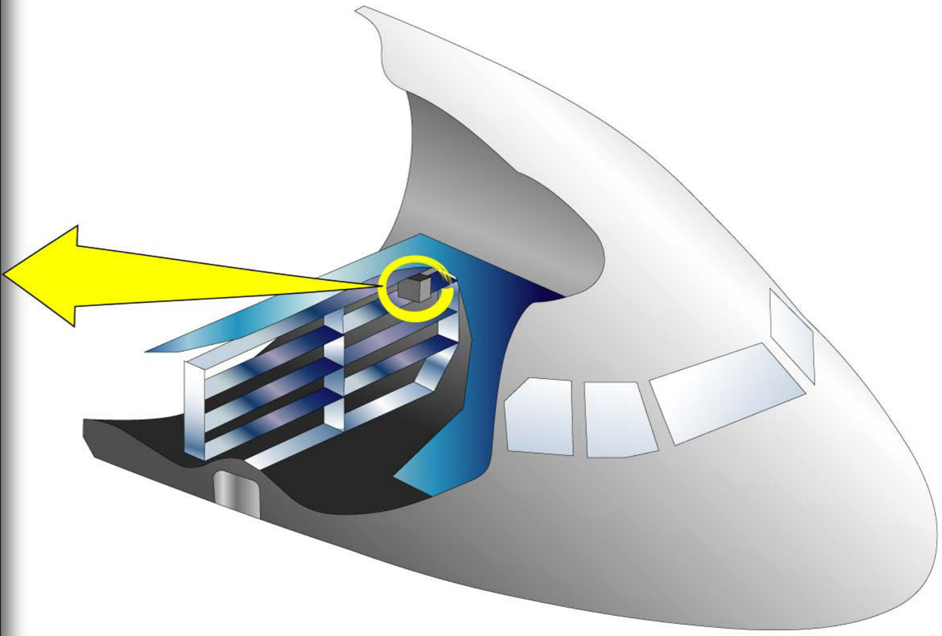
46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

COMPONENT LOCATION

The ATSU is in the 81VU in the avionics compartment.

U7Z08431 - U0OT4T0 - UM46PZ000000001

Air Traffic Service Unit (ATSU) (81VU)



COMPONENT LOCATION

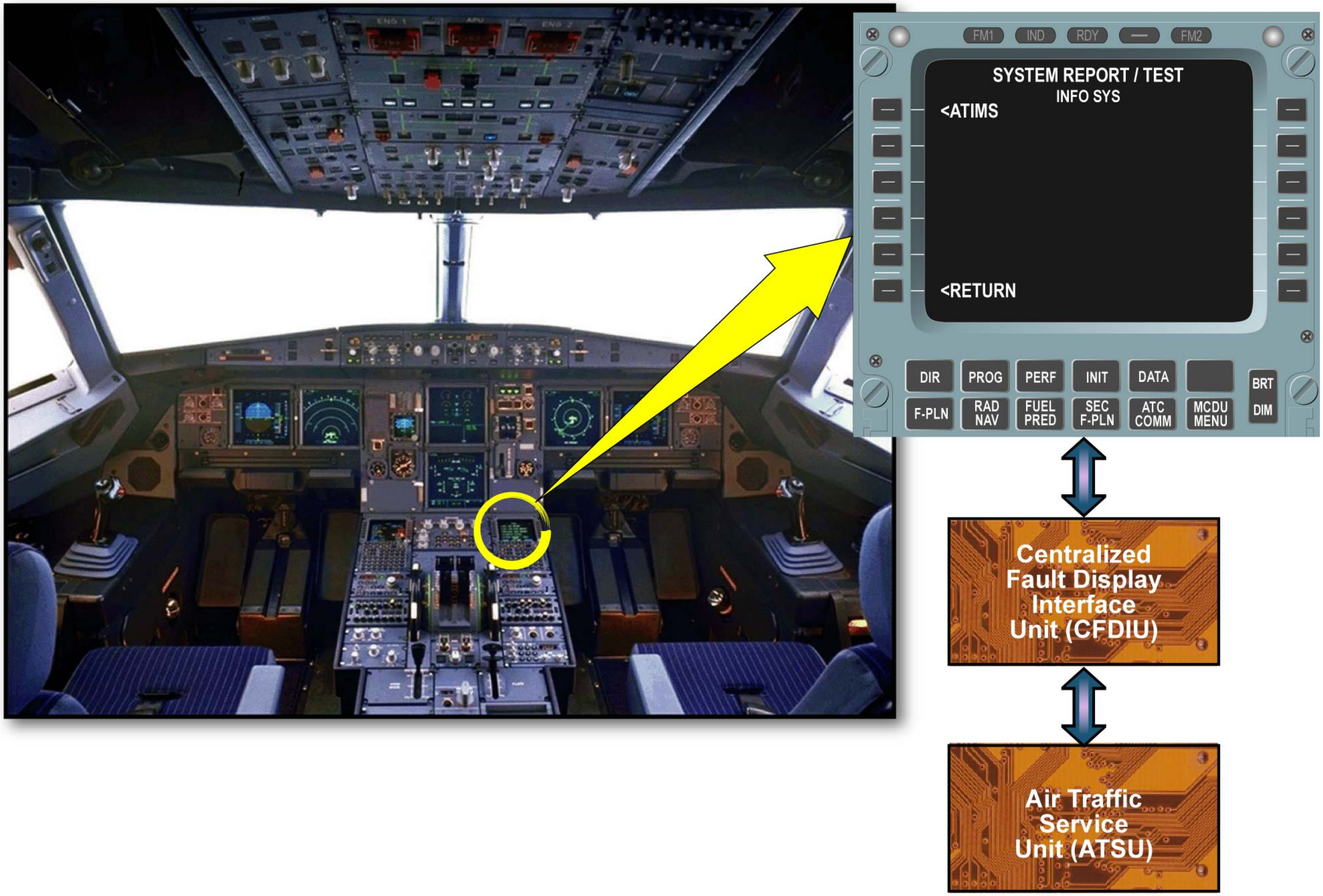
U7Z08431 - U0OT4T0 - UM46PZ000000001

46 AIR TRAFFIC INFO MANAGEMENT SYS PRES. (1)

MAINTENANCE/TEST FACILITIES

The ATIMS BITE information and test request are available through MCDU menus which communicate with the ATSU BITE.
The ATIMS maintenance menu is accessible using the "ATIMS" prompt from the COM SYSTEM REPORT/TEST page.

U7Z08431 - U0OT4T0 - UM46PZ000000001



MAINTENANCE/TEST FACILITIES

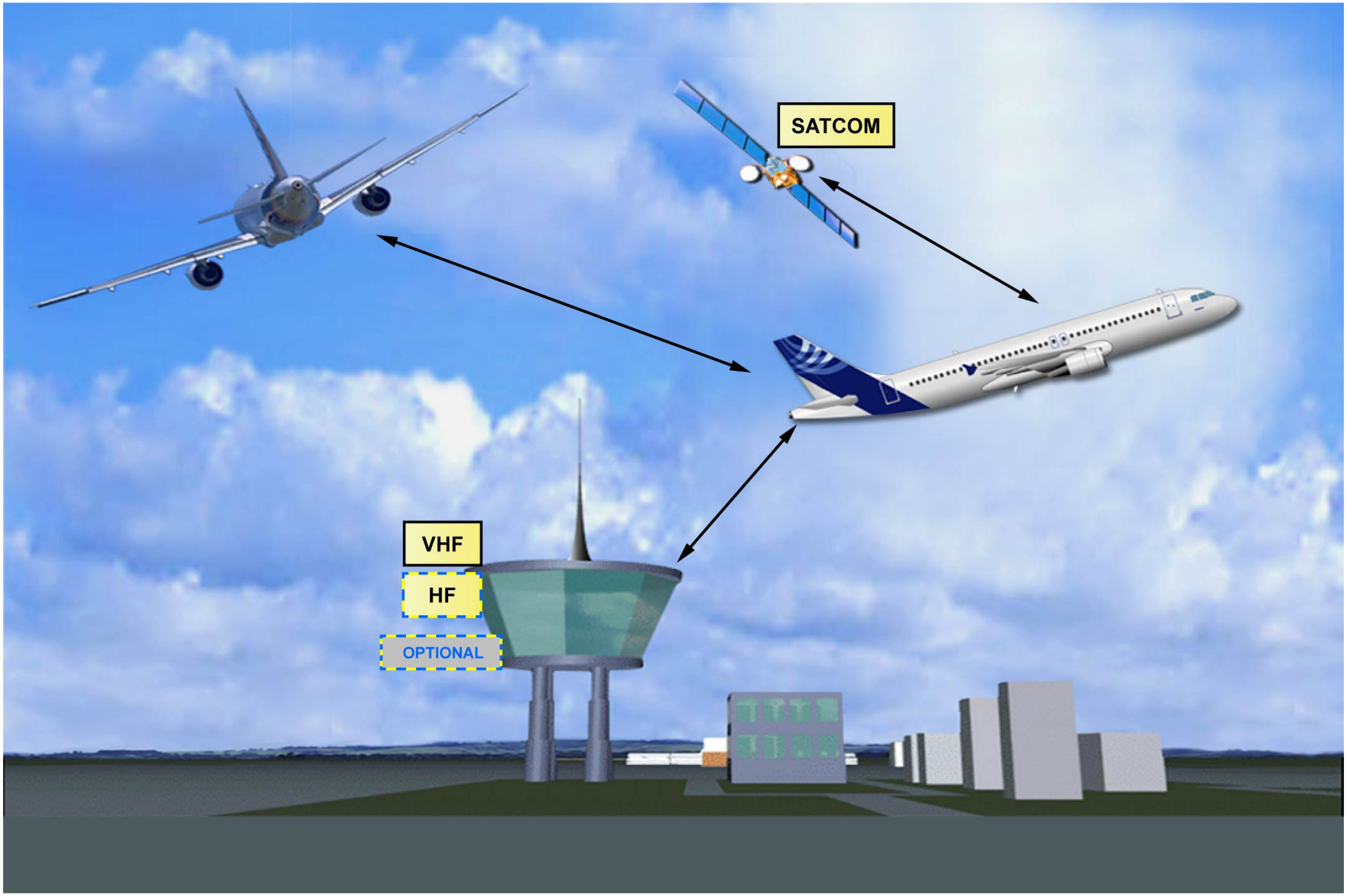
U7Z08431 - U0OT4T0 - UM46PZ000000001

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

GENERAL

The single aisle aircraft communication system has two sub-systems:
- radio communication,
- on-board communication.

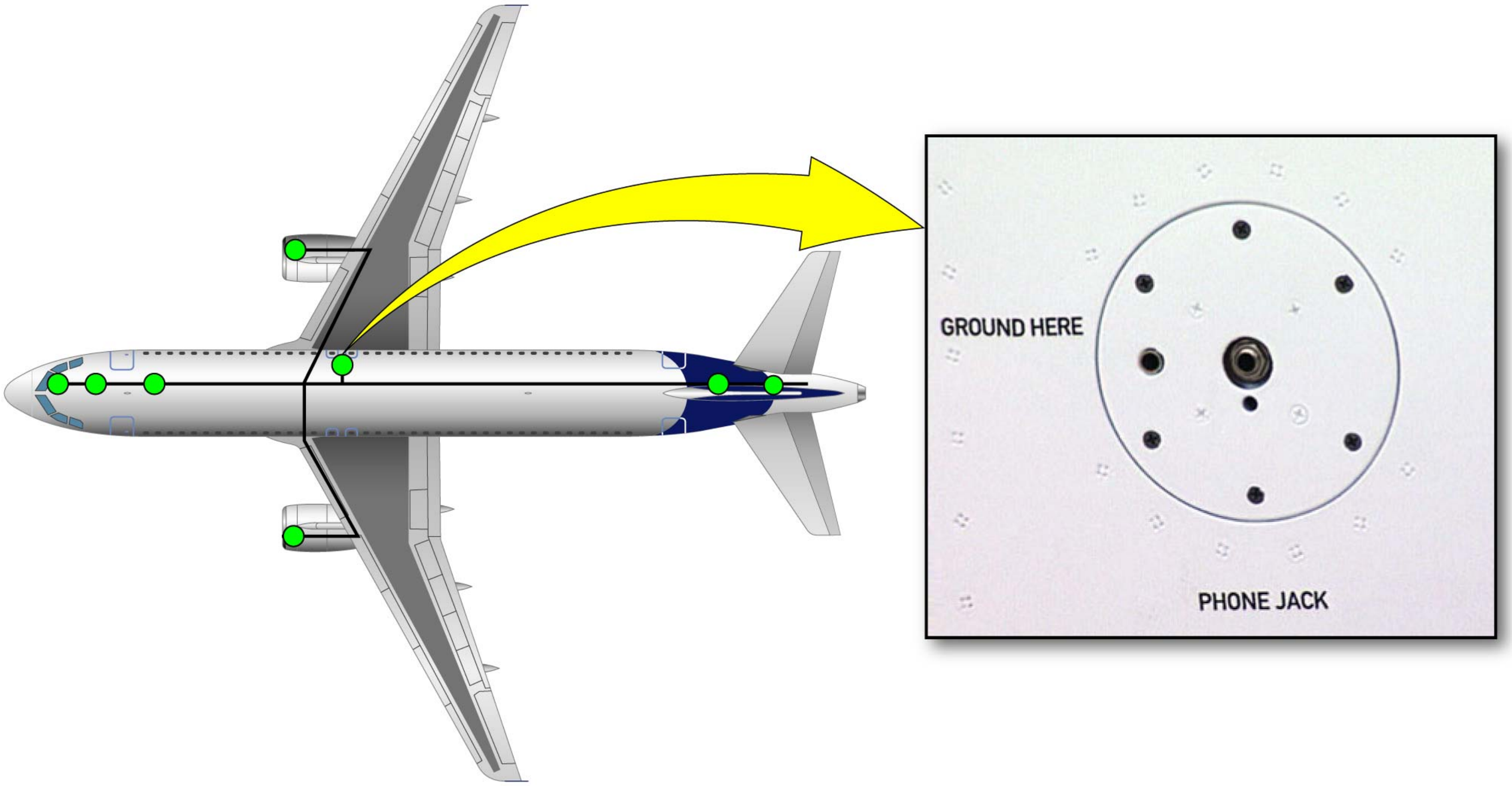
The radio communication systems are used for communications to and from the aircraft.
The on-board internal communication system is divided into 4 functions:
- service interphone (on ground only) for maintenance technician communication with cockpit or cabin thanks to several jack connectors around the A/C.
- Flight interphone for cockpit internal communication and also with the ground mechanic,
- Passenger Address (PA) from the cockpit or from cabin crew stations for passenger announcements,
- cabin interphone for cabin crew or cabin crew/pilots communication.



U7Z08431 - U0OT4T0 - UM23PZ000000002

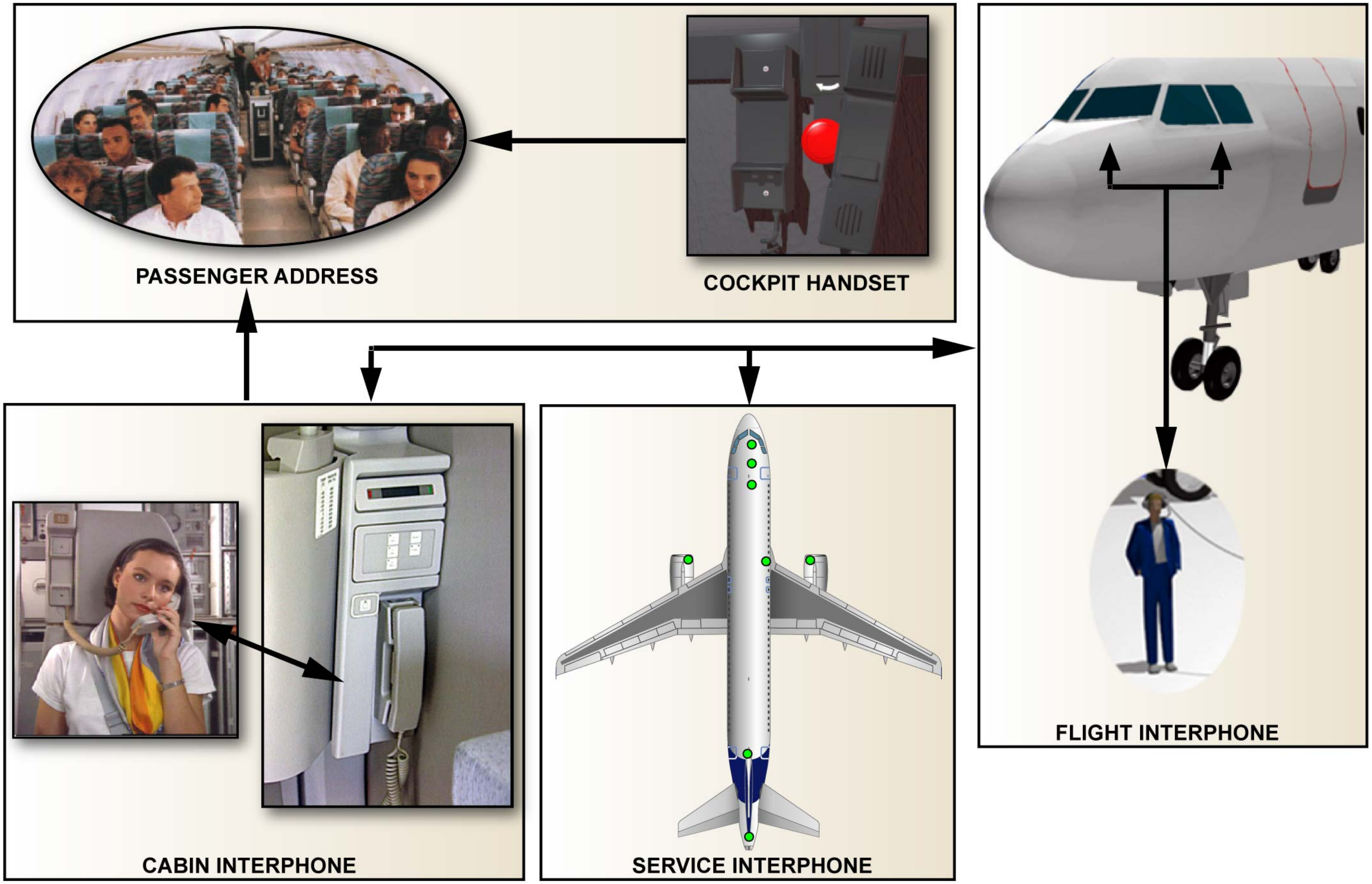
GENERAL

SERVICE INTERPHONE JACK CONNECTORS



U7Z08431 - U0OT4T0 - UM23PZ000000002

GENERAL



GENERAL

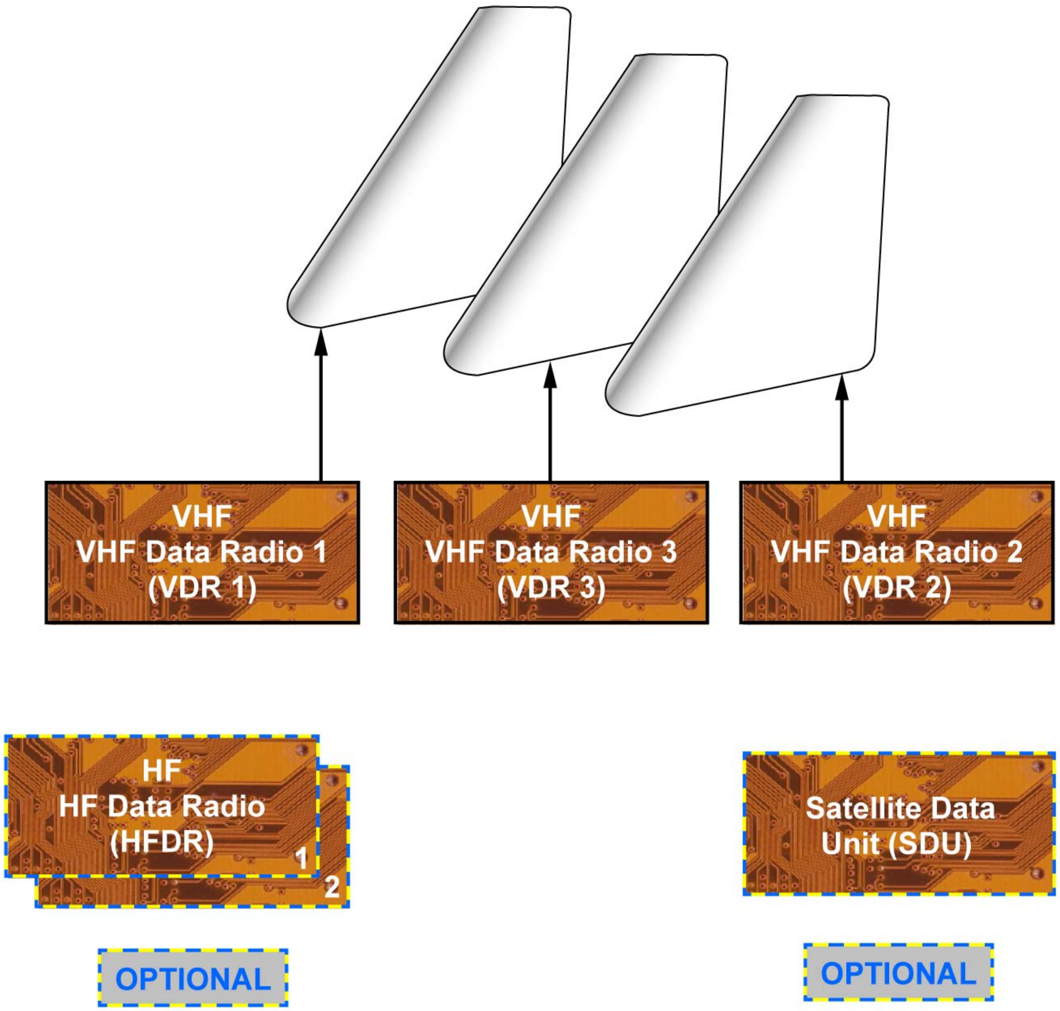
U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

RADIO COMMUNICATION SYSTEM

The radio communications system lets the crew communicate with ground stations and to other aircrafts through VHF Data Radio (VDR), High Frequency Data Radio (HFDR) and SATCOM if installed.
The VHF transceivers are identical and interchangeable, as are the HF transceivers. VDR 1 and VDR 2 are normally used by the flight crew for voice communications. VDR 3 is used for Aircraft Communication Addressing and Reporting System (ACARS) functions, and is used as back-up voice communications in case of system 1 or 2 failure.
The HF transceivers are used when the aircraft is beyond the useful range of the VHF radios.

U7Z08431 - U0OT4T0 - UM23PZ000000002



RADIO COMMUNICATION SYSTEM

U7Z08431 - U0OT4T0 - UM23PZ000000002

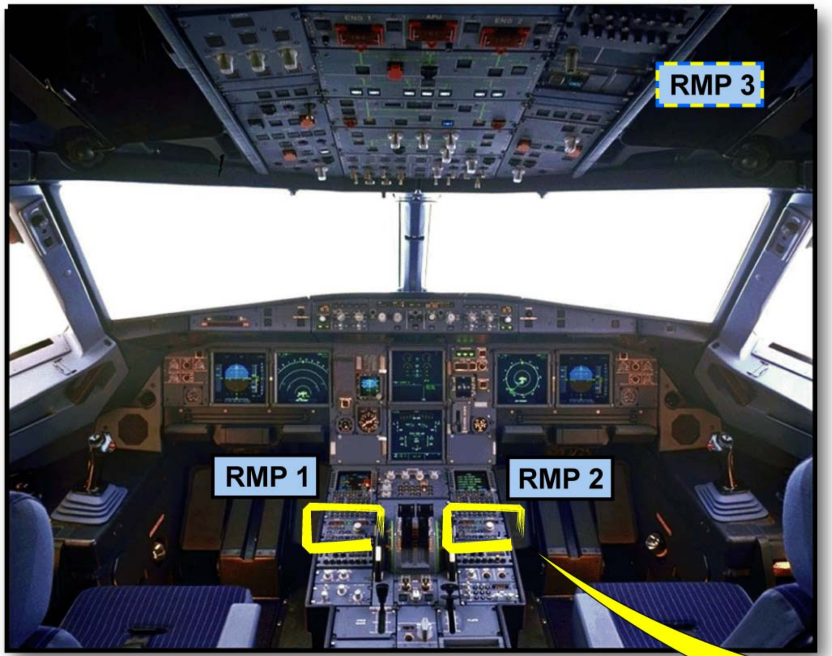
23 COMMUNICATIONS SYSTEM PRESENTATION (1)

RADIO COMMUNICATIONS CONTROL AND INDICATING

RMP

The Radio Management Panels (RMPs) give the capability of tuning all communication radios. The frequencies are tuned by using the 2 concentric knobs.
There are two RMPs located on the center pedestal and a third optional one on the overhead panel.
Any RMP can tune any communication radio but each one is normally dedicated to a particular radio.
- RMP 1 is dedicated to VDR 1,
- RMP 2 is dedicated to VDR 2,
- RMP 3 is dedicated to VDR 3 and HF 1/HF 2 (if installed).

U7Z08431 - U0OT4T0 - UM23PZ000000002



OPTIONAL

RMP: Radio Management Panel

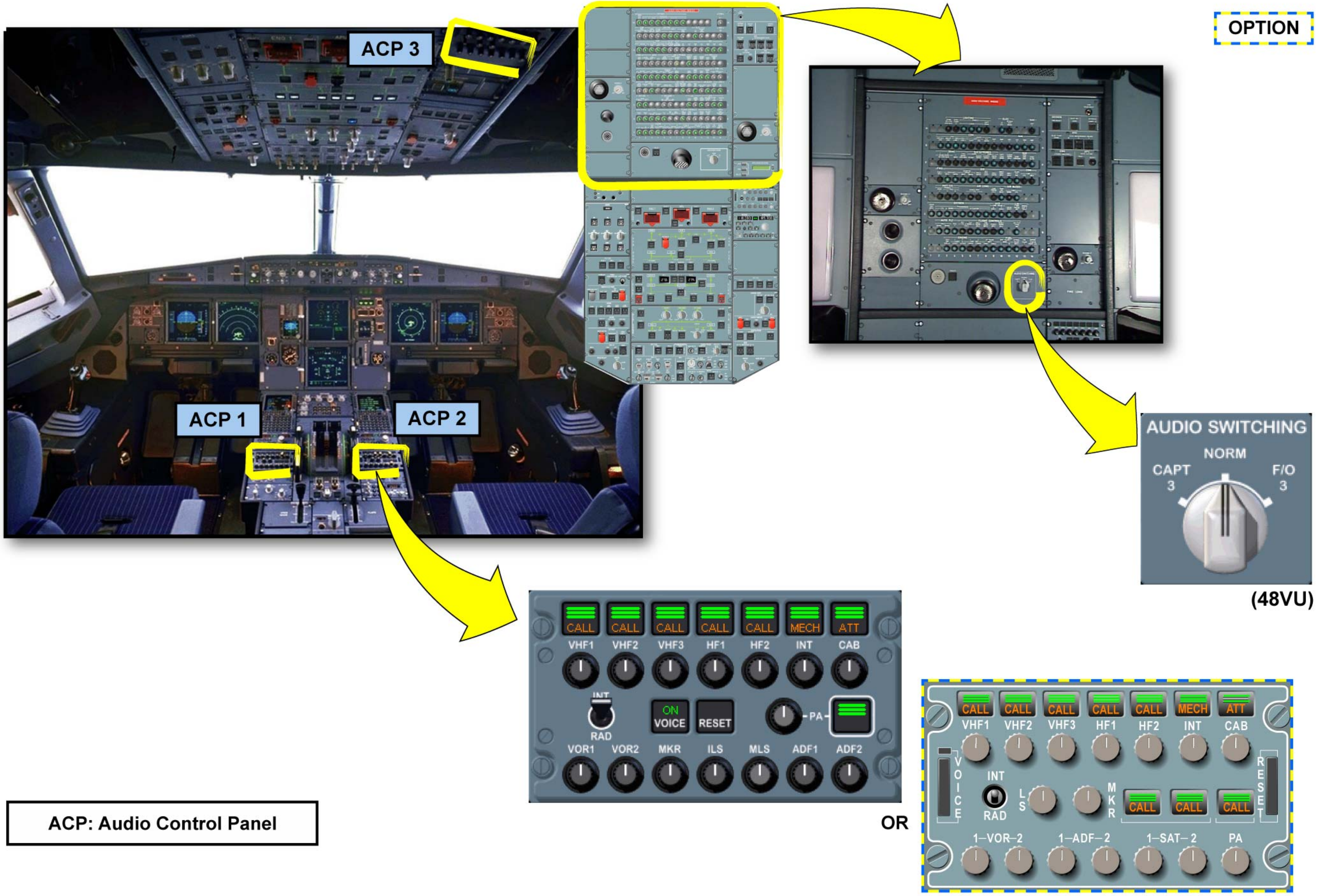
RADIO COMMUNICATIONS CONTROL AND INDICATING - RMP

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

RADIO COMMUNICATIONS CONTROL AND INDICATING (continued)

ACP

There are three Audio Control Panels (ACPs), each one is located close to a RMP. The ACPs allow for audio channel selection for both transmission and reception. Additionally, the ACP provides individual volume control for reception channels. ACP 1 is dedicated to the captain and ACP 2 is dedicated to the F/O. Both ACPs 1 and 2 are located on the center pedestal left and right respectively. A third optional ACP is located on overhead panel and is dedicated for a third occupant and may be used as a back up for captain or first officer in case of failure.



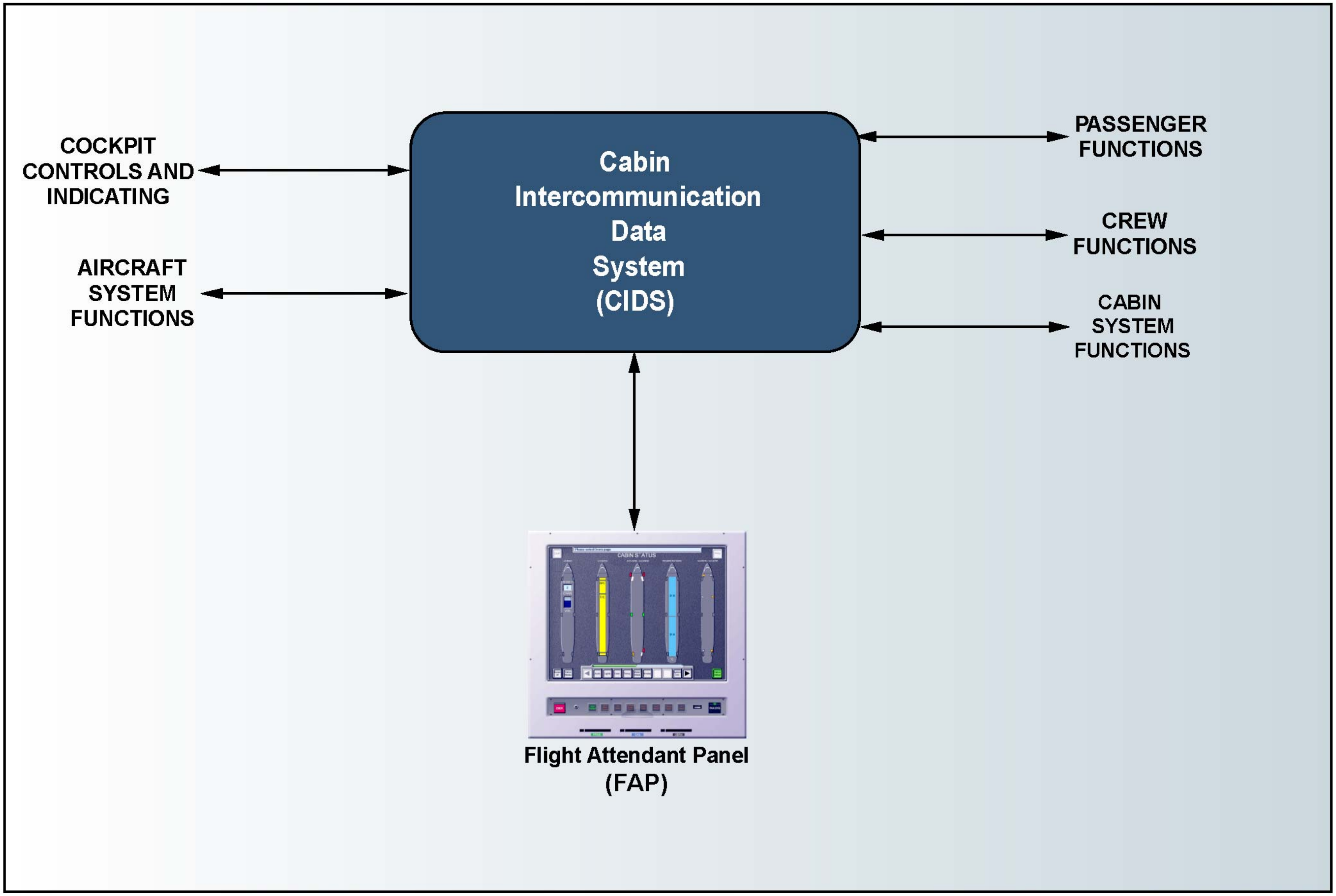
RADIO COMMUNICATIONS CONTROL AND INDICATING - ACP

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

ON-BOARD COMMUNICATIONS

Of the four on-board communication systems, two Cabin Intercommunications Data System (CIDS) directors control three of the four functions. The CIDS directors manage the following on-board communication functions:
- PA system for passenger announcements (from the cockpit or from cabin crew stations),
- cabin interphone system for crew communication (cabin together or with cockpit),
- service interphone.

The CIDS directors do not manage the flight interphone.



ON-BOARD COMMUNICATIONS

U7Z08431 - U0OT4T0 - UM23PZ000000002

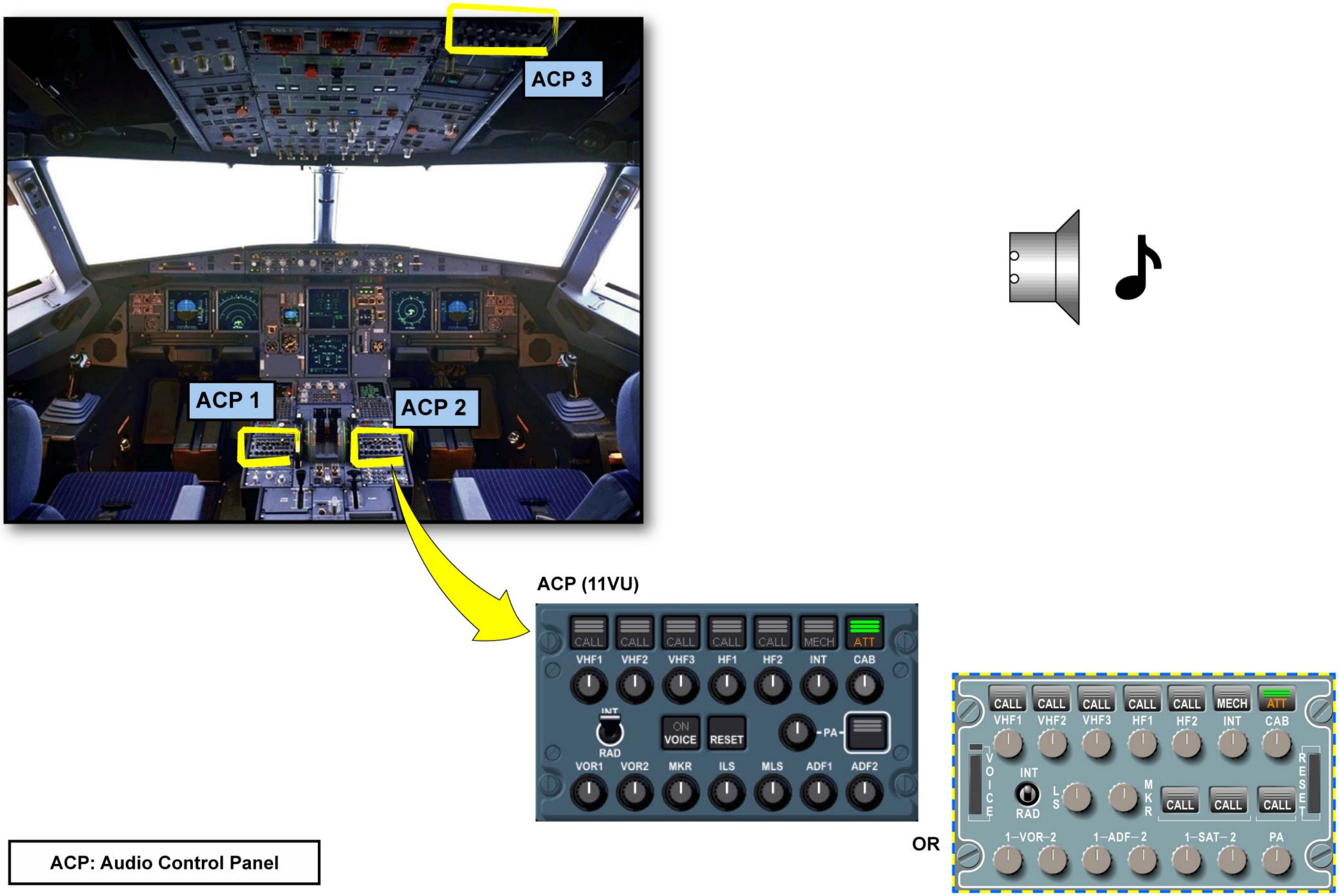
23 COMMUNICATIONS SYSTEM PRESENTATION (1)

ON-BOARD COMMUNICATION CONTROL AND INDICATING

ACP

The ACPs also give to the flight crew the ability to communicate with ground personnel and cabin crew and annunciate calls to the flight deck.
Calls to the flight deck can be made from any of the cabin attendant handsets. Mechanic calls can also be made from the External Power Panel. This will cause a buzzer to sound and a CALL light to come on, on the ACPs.

U7Z08431 - U0OT4T0 - UM23PZ000000002



ON-BOARD COMMUNICATION CONTROL AND INDICATING - ACP

U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

ON-BOARD COMMUNICATION CONTROL AND INDICATING (continued)

FLIGHT INTERPHONE

This system allows the flight crew members to communicate among themselves and through a jack on the external power panel (108VU) with the ground mechanic.

U7Z08431 - U0OT4T0 - UM23PZ000000002

EXTERNAL POWER CONTROL PANEL (108VU)

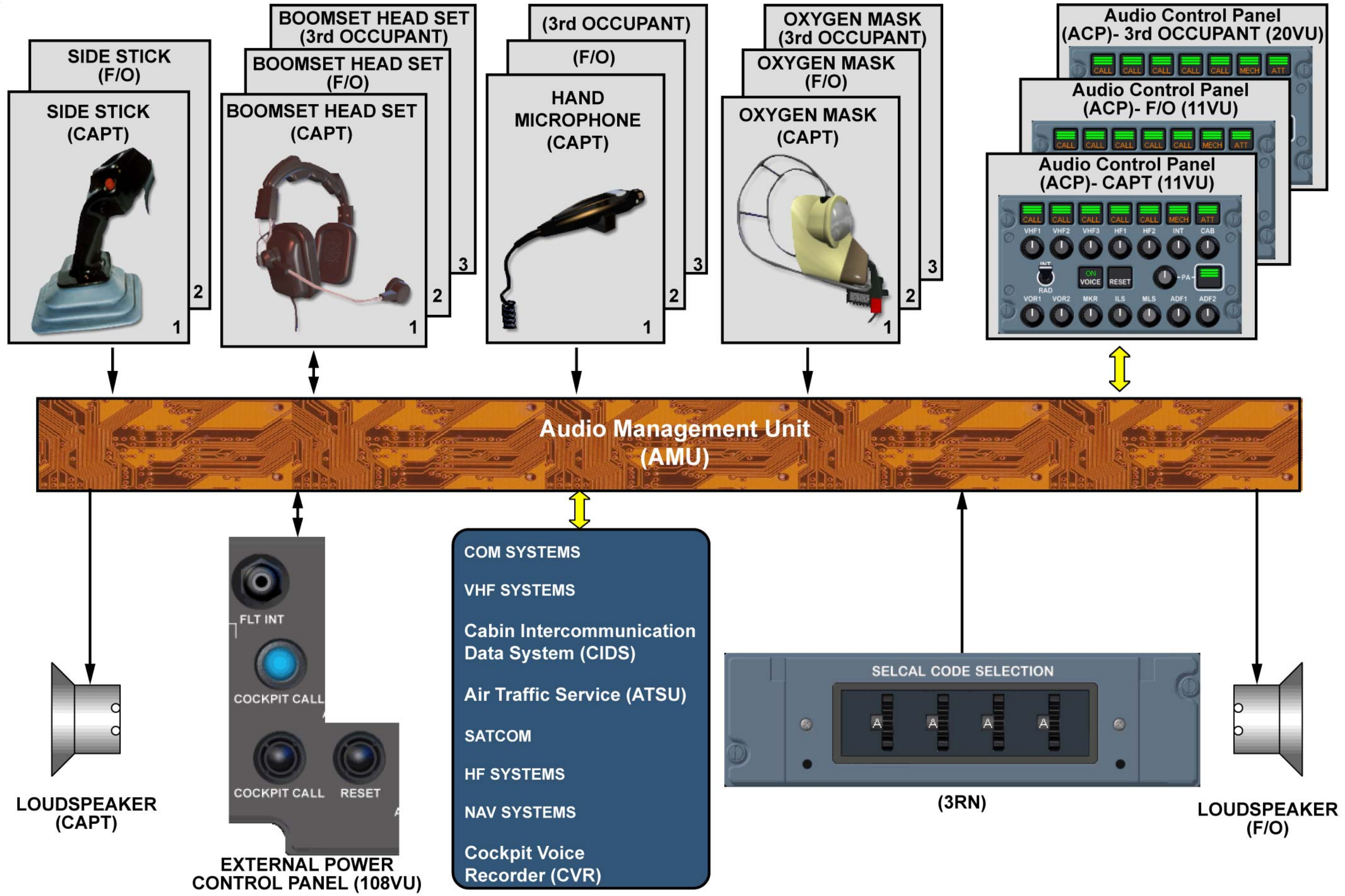
ON-BOARD COMMUNICATION CONTROL AND INDICATING - FLIGHT INTERPHONE

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

ON-BOARD COMMUNICATION CONTROL AND INDICATING (continued)

AMU

The heart of the audio system is the Audio Management Unit (AMU). It routes the signals generated by the crew and directs the signals to and from the appropriate radio or interphone system.
The AMU has a decoding unit called Selective Calling (SELCAL). It lets aural and visual indications on the ACP with an amber CALL indication to alert the flight crew for calls from ground stations. When the PA function is used from cockpit the audio signal is routed via the AMU to the CIDS director and from the director to the Decoder Encoder Units (DEUs) for distribution in the cabin.



ON-BOARD COMMUNICATION CONTROL AND INDICATING - AMU

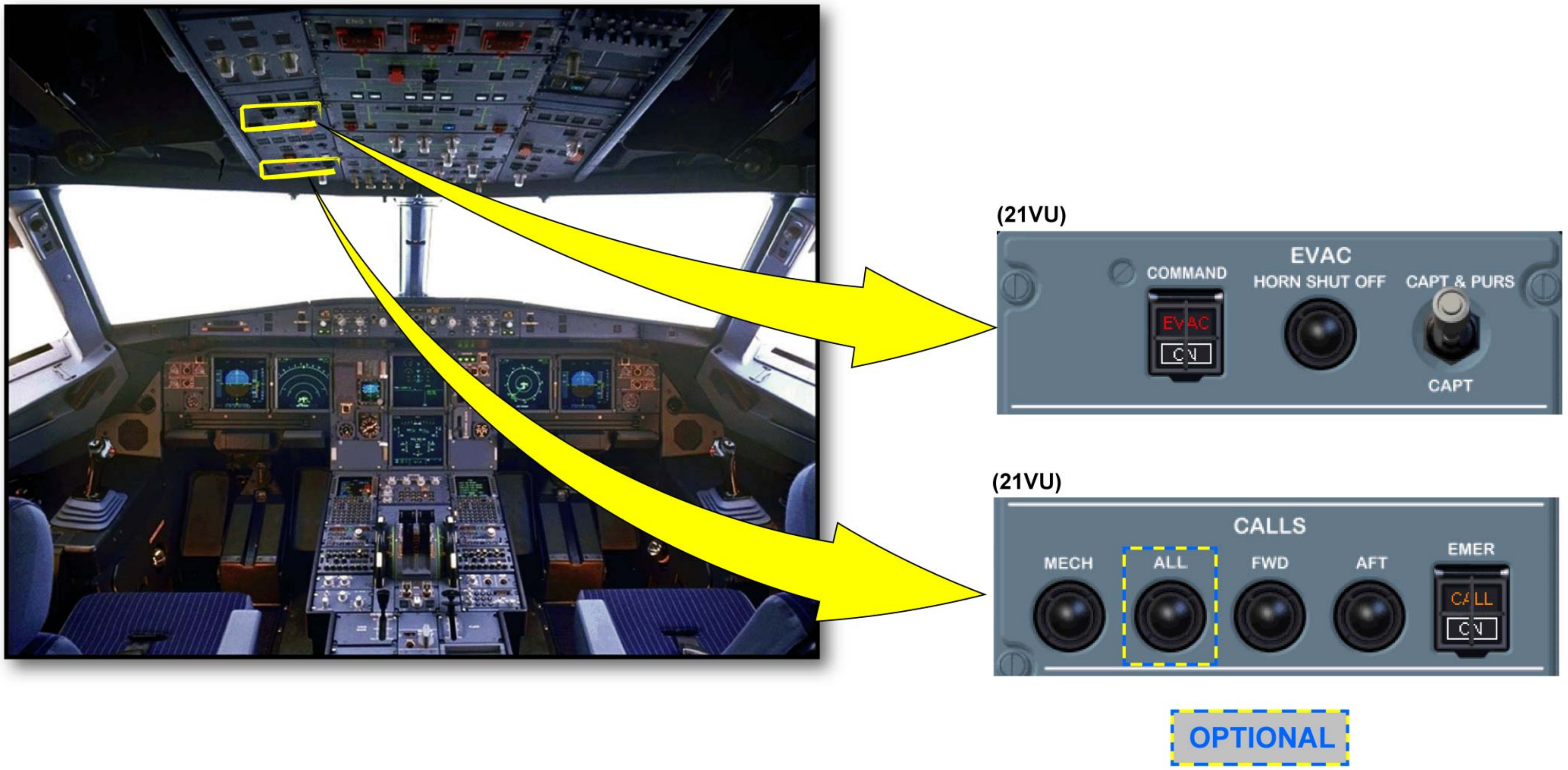
U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

ON-BOARD COMMUNICATION CONTROL AND INDICATING (continued)

CALLS PANEL

The CALL panel lets the cockpit crew gain the attention of a ground mechanic or the cabin crew by triggering visual and audio signals.
For mechanic call the horn will sound, for cabin crew a high low chime will be broadcast on respective areas.
The EVAC panel is located on the overhead panel in the cockpit. It allows the evacuation command to be activated from the cockpit only or from the cockpit and the purser station.



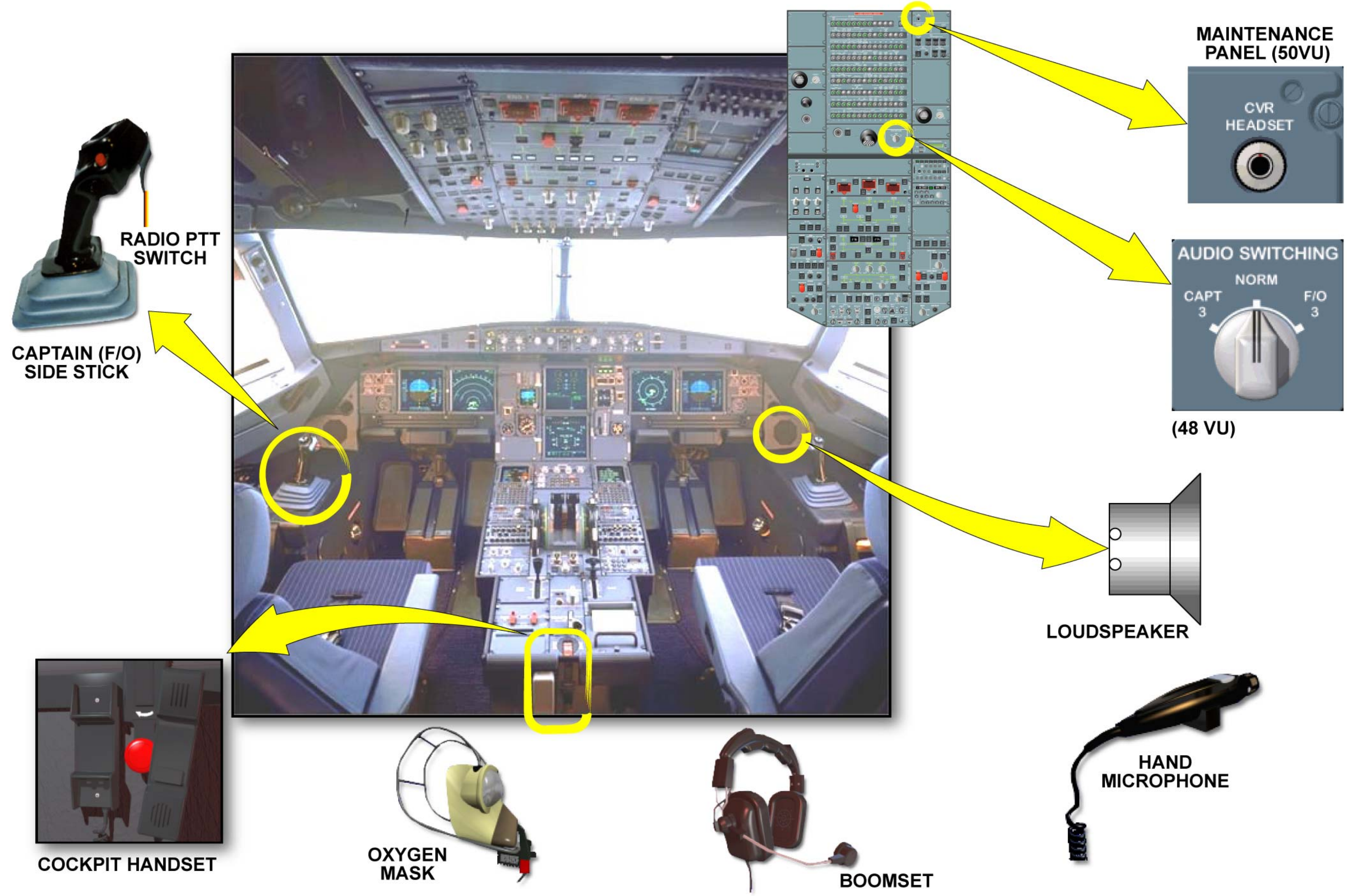
U7Z08431 - U0OT4T0 - UM23PZ000000002

ON-BOARD COMMUNICATION CONTROL AND INDICATING - CALLS PANEL

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

COMPONENT LOCATION

Several peripherals and acoustic equipment are installed in the cockpit.



U7Z08431 - U0OT4T0 - UM23PZ000000002

COMPONENT LOCATION

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

ANTENNAS

All the antennae are located on the outer skin of the aircraft except the HF antenna located behind the leading edge of the vertical stabilizer.

COMPONENT LOCATION - ANTENNAS

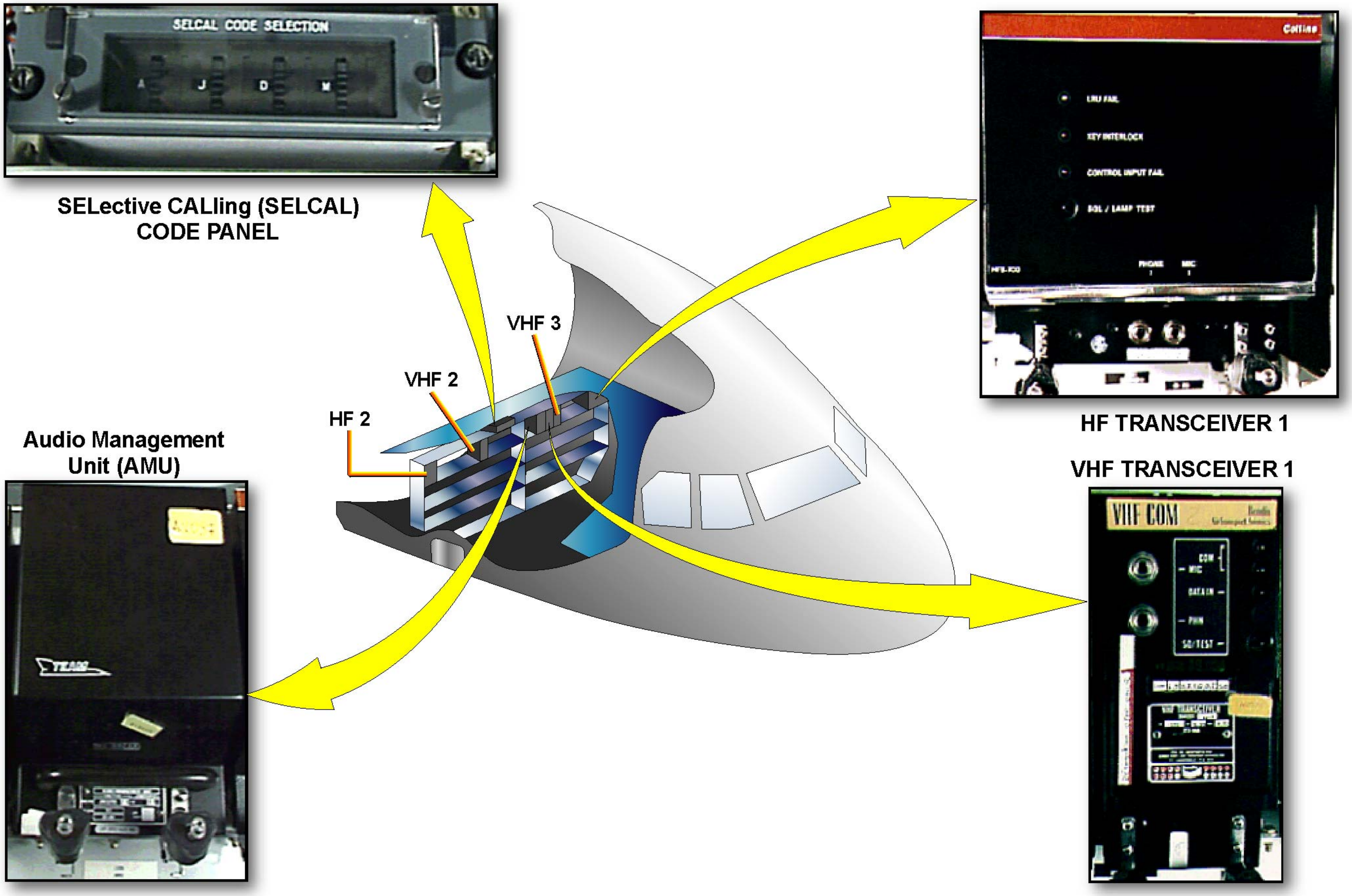
U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

TRANSCEIVERS, AMU, SELCAL CODE PANEL

The SELCAL panel, AMU, HF and VHF Line Replaceable Units (LRUs) are located in the aft avionics compartment.



COMPONENT LOCATION - TRANSCEIVERS, AMU, SELCAL CODE PANEL

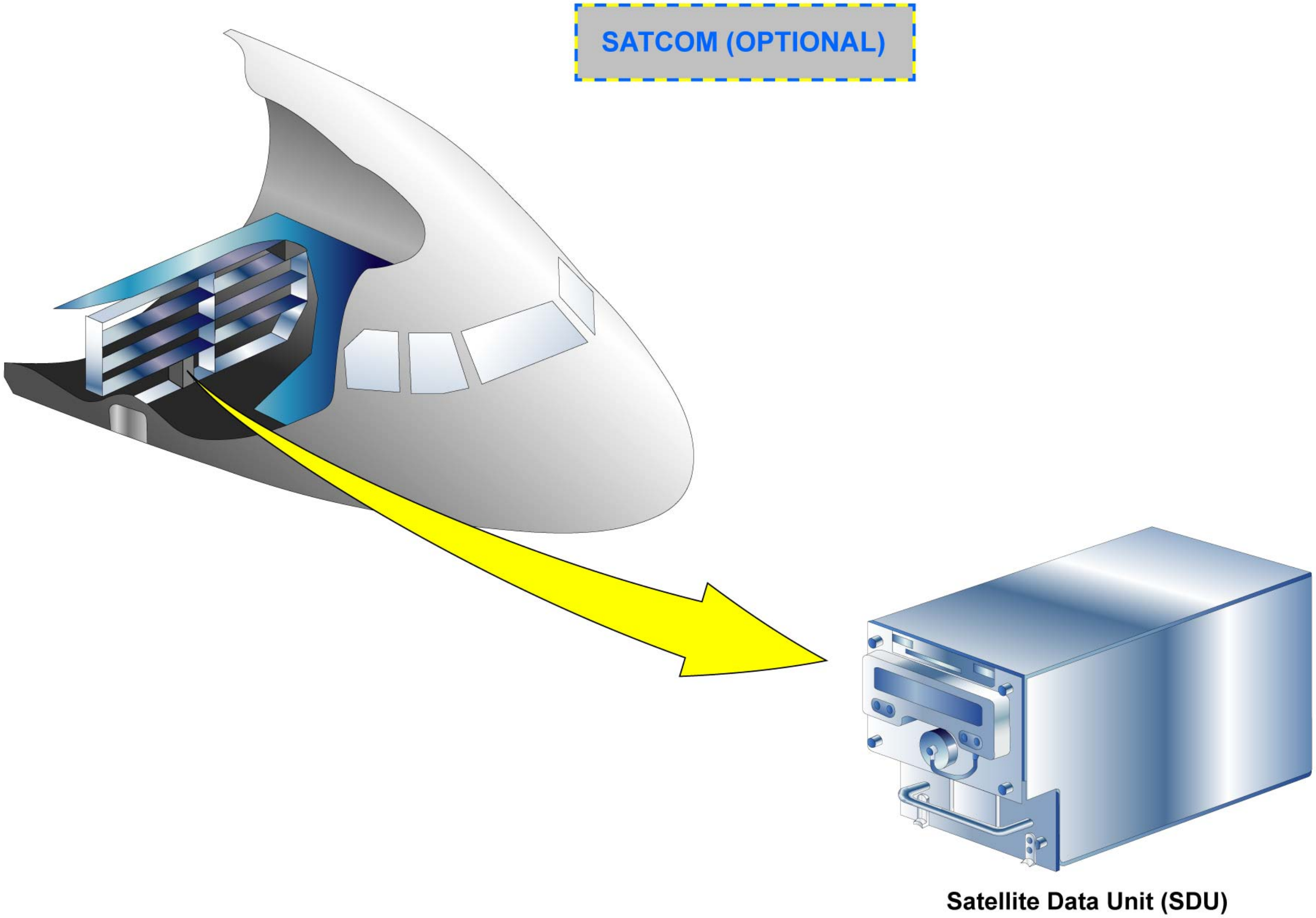
U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

SATCOM (OPTION)

The SATellite COMmunication system (SATCOM) is composed of the Satellite Data Unit (SDU),
The SATCOM is a multi channel aviation satellite communication system. It supplies worldwide mobile radio communications that can handle voice and Data. The SDU is located in the aft avionics rack 80VU. The function is selected through the ACP.



COMPONENT LOCATION - SATCOM (OPTION)

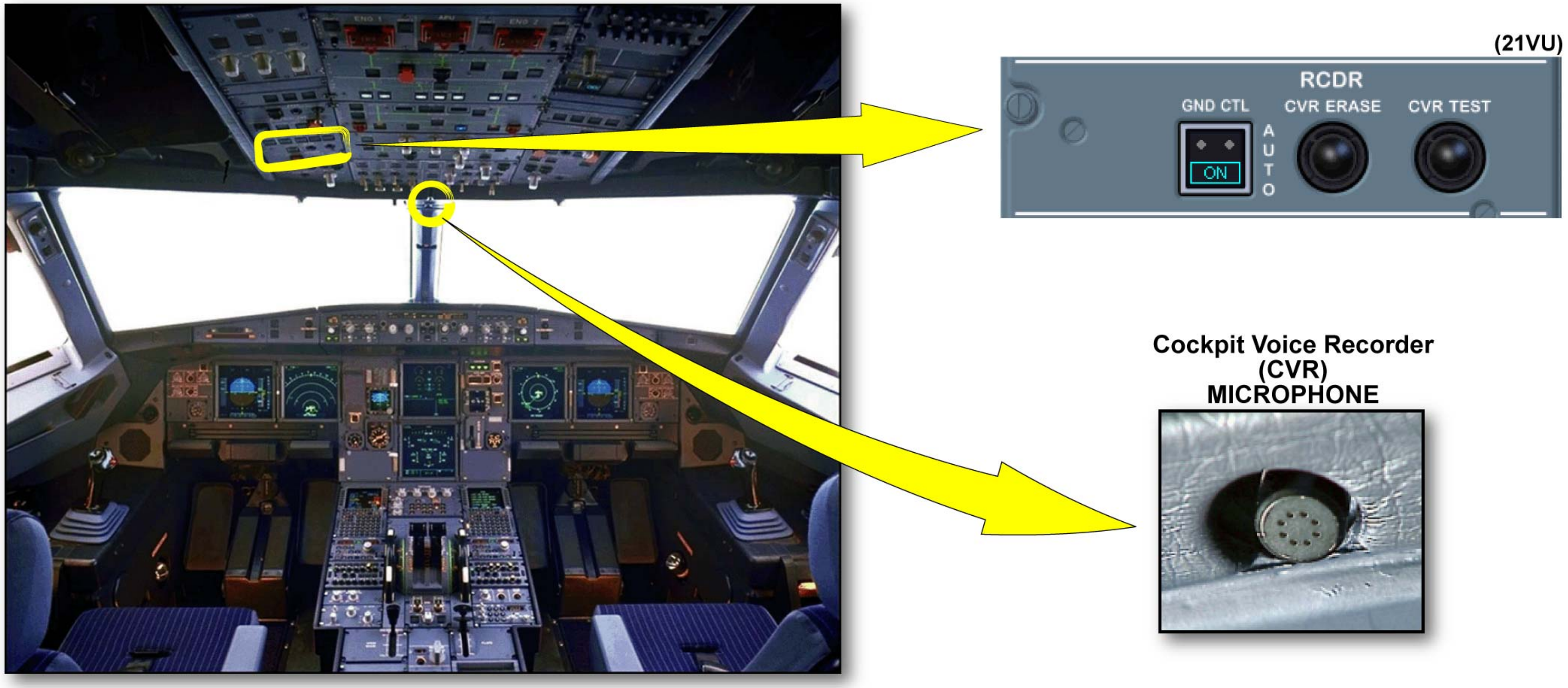
23 COMMUNICATIONS SYSTEM PRESENTATION (1)

SOLID STATE COCKPIT VOICE RECORDER-SSCVR

The cockpit voice recorder records the last 2 hours of the flight crew conversations and communications and aural warnings. It records automatically in flight and on ground when at least 1 engine is running and for 5 minutes after the last engine is shut down and also 5 minutes after aircraft energization.

SSCVR CONTROL AND INDICATING

The Cockpit Voice Recorder (CVR) control panel gives CVR controls for manual erasure and test of the recording.
The CVR microphone is located at the bottom of the overhead panel.



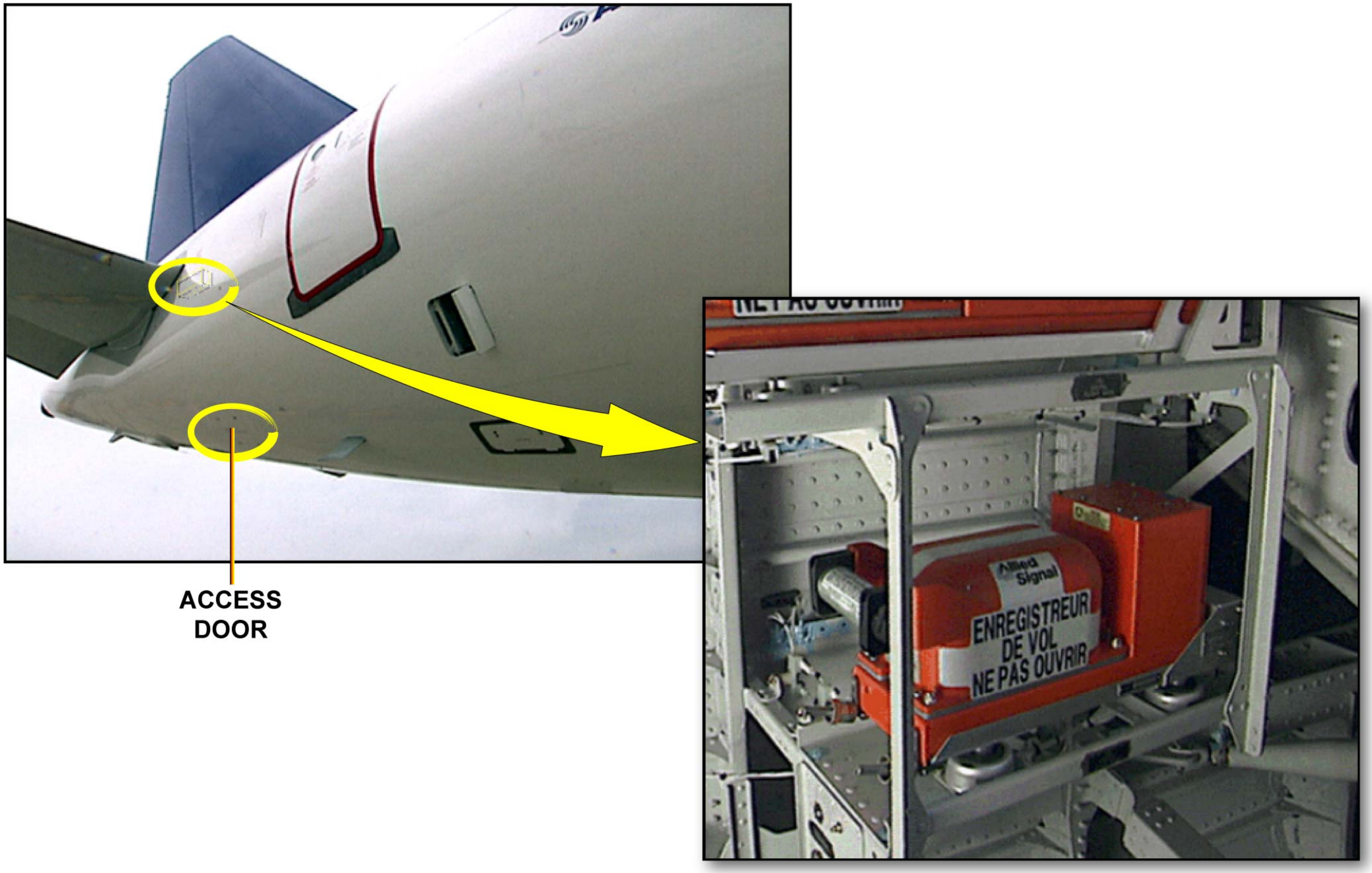
U7Z08431 - U0OT4T0 - UM23PZ000000002

SOLID STATE COCKPIT VOICE RECORDER-SSCVR & SSCVR CONTROL AND INDICATING

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

SSCVR COMPONENT LOCATION

The CVR is located in the rear fuselage.



SSCVR COMPONENT LOCATION

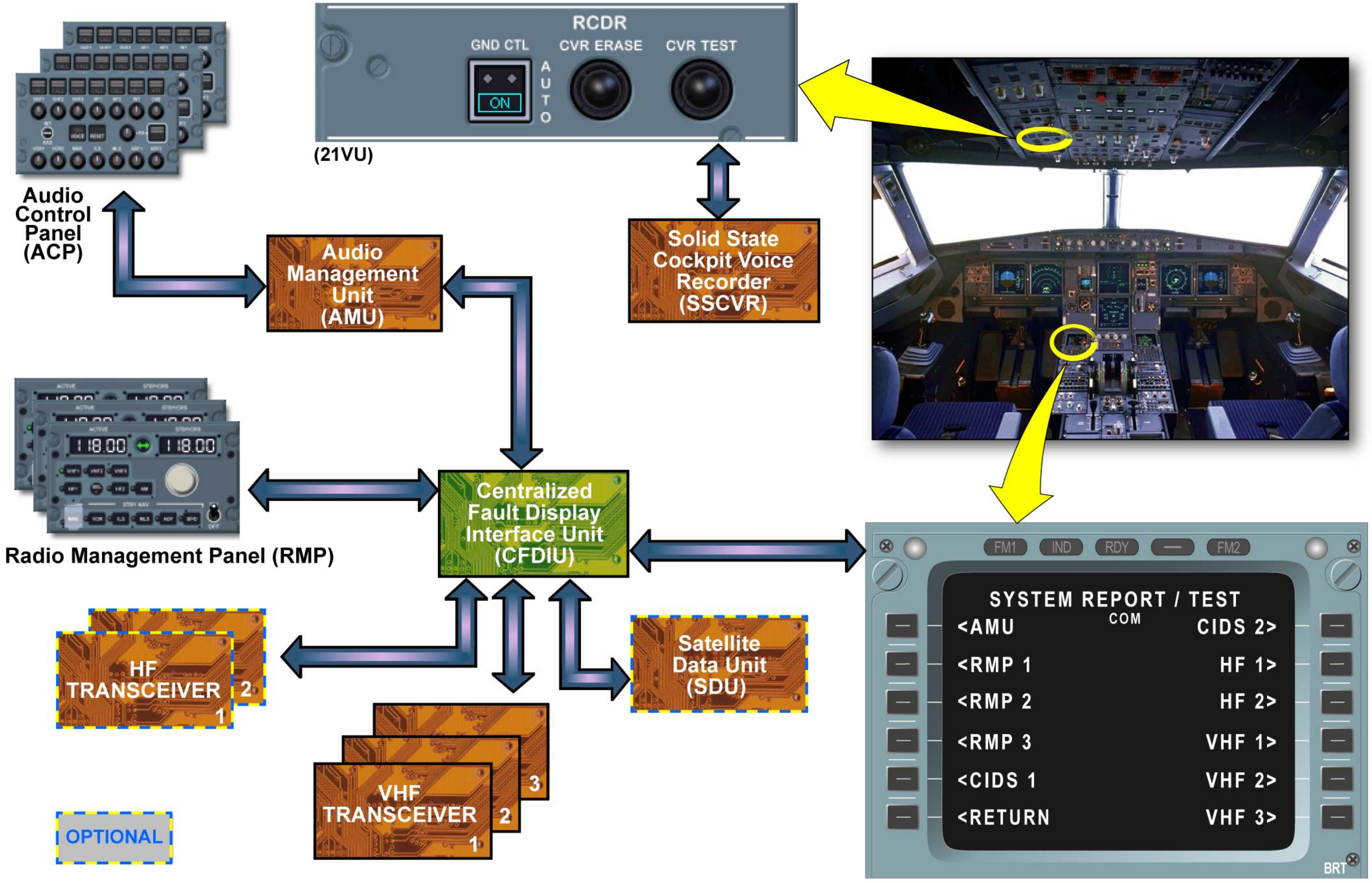
U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

All the communication sub-systems can be tested through the MCDU except the CVR system.

U7Z08431 - U0OT4T0 - UM23PZ000000002



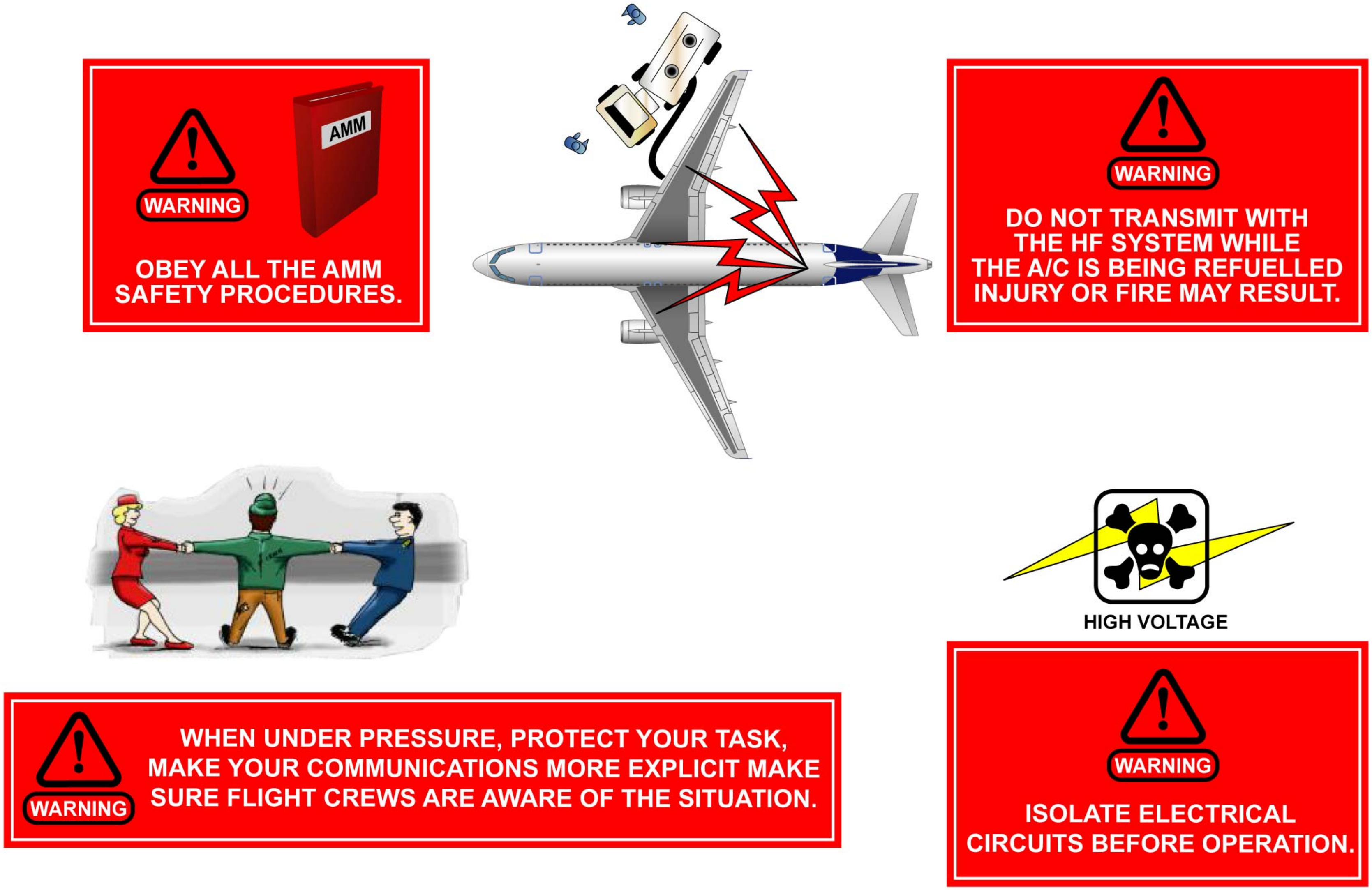
MAINTENANCE/TEST FACILITIES

U7Z08431 - U0OT4T0 - UM23PZ000000002

23 COMMUNICATIONS SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on aircraft, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures.
This will prevent injury to persons and/or damage to aircraft. Here is an overview of main safety precautions related to the communications system.
Make sure that all circuits in maintenance are isolated before you apply electrical power to the aircraft. Unwanted electrical power can be dangerous.
Although the HF antenna is mounted under the leading edge of the vertical stabilizer, the RF energy generated during transmissions can cause an explosion during refueling. DO NOT TRANSMIT during refueling.
When working on the aircraft make sure that you focus on the tasks. Interruptions can lead to errors. These errors can lead to an accident. To avoid these interruptions it is prudent to advise the flight crew, ground crew and cabin crew of your progress. This will relieve anxiety of the passengers, and crew members. They will not interrupt you as often, leaving you the time to focus on your tasks.



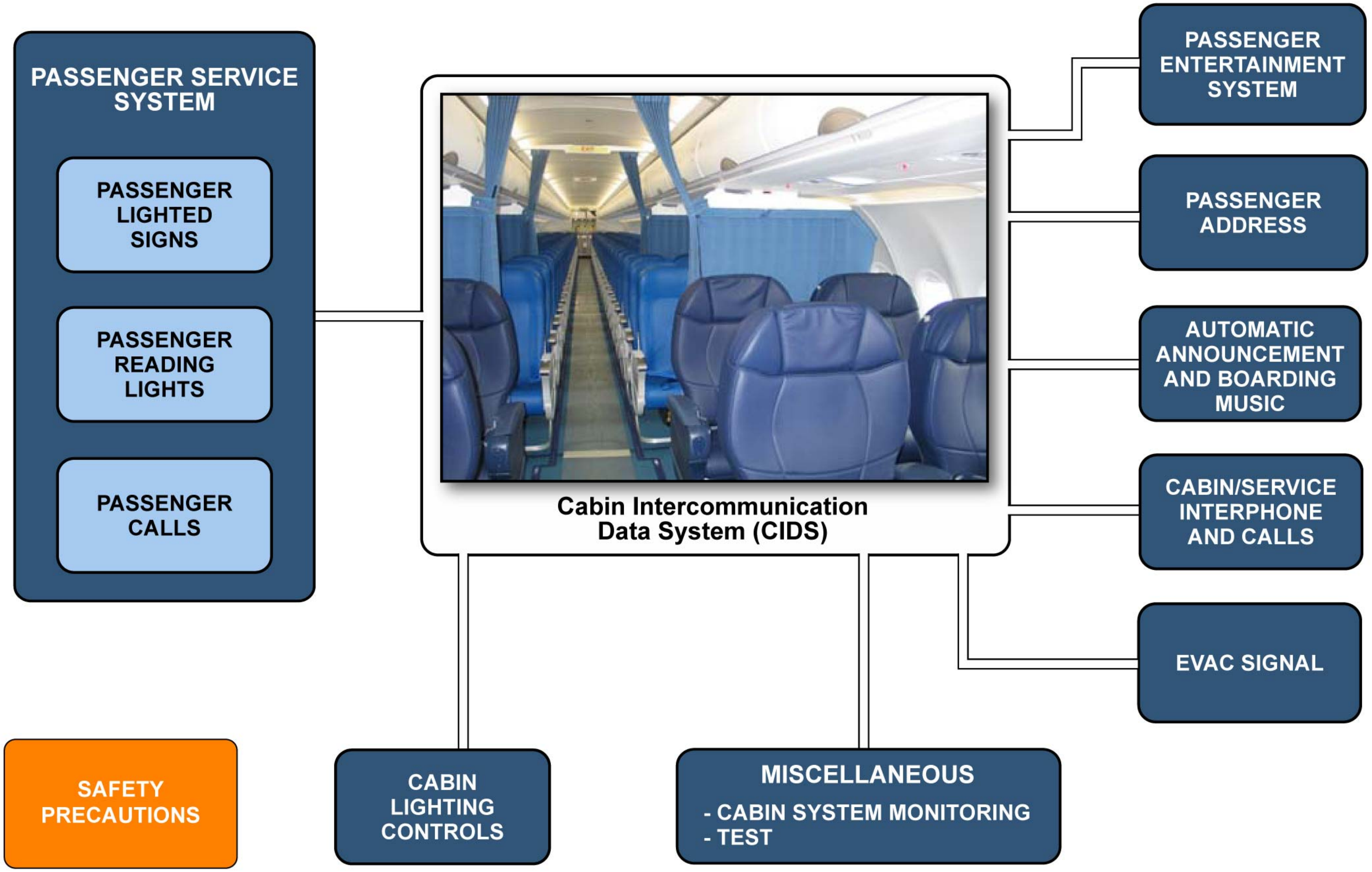
SAFETY PRECAUTIONS

U7Z08431 - U0OT4T0 - UM23PZ000000002

23 CIDS SYSTEM PRESENTATION (1)

GENERAL

The Cabin Intercommunication Data System (CIDS) is used for the control and management of all the cabin systems presented in the graphic.



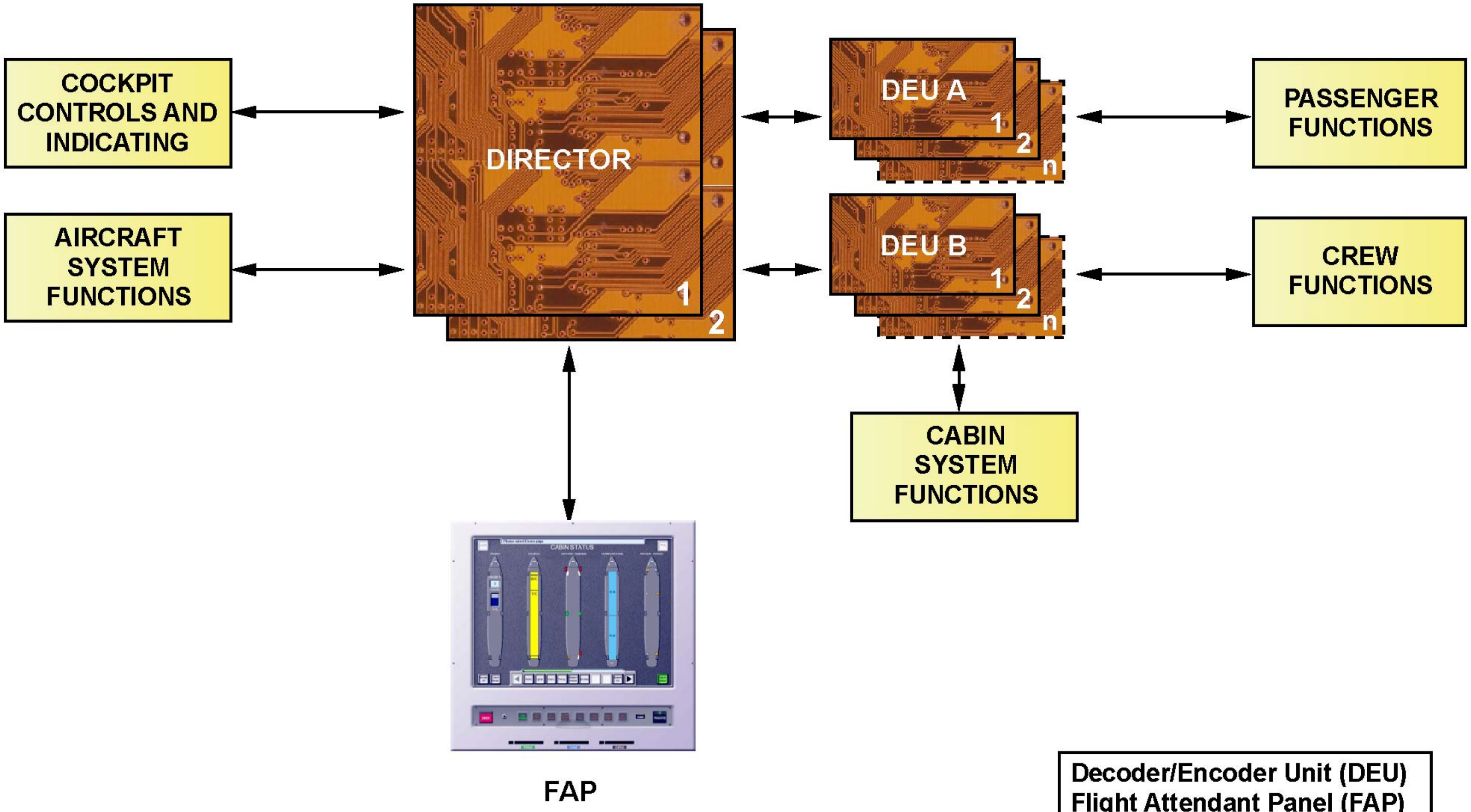
U7Z08431 - U0OT4T0 - UM23PY000000002

GENERAL

23 CIDS SYSTEM PRESENTATION (1)

CABIN INTERCOMMUNICATION DATA SYSTEM

The CIDS includes two directors, a touch-screen Flight Attendant Panel (FAP), and the DEUs. The touch screen FAP controls and indicates the status of the CIDS. Integrated within the FAP are Cabin Assignment Module (CAM), On Board Replaceable Module (OBRM) and Prerecorded Announcement and Music (PRAM) in flash card format.



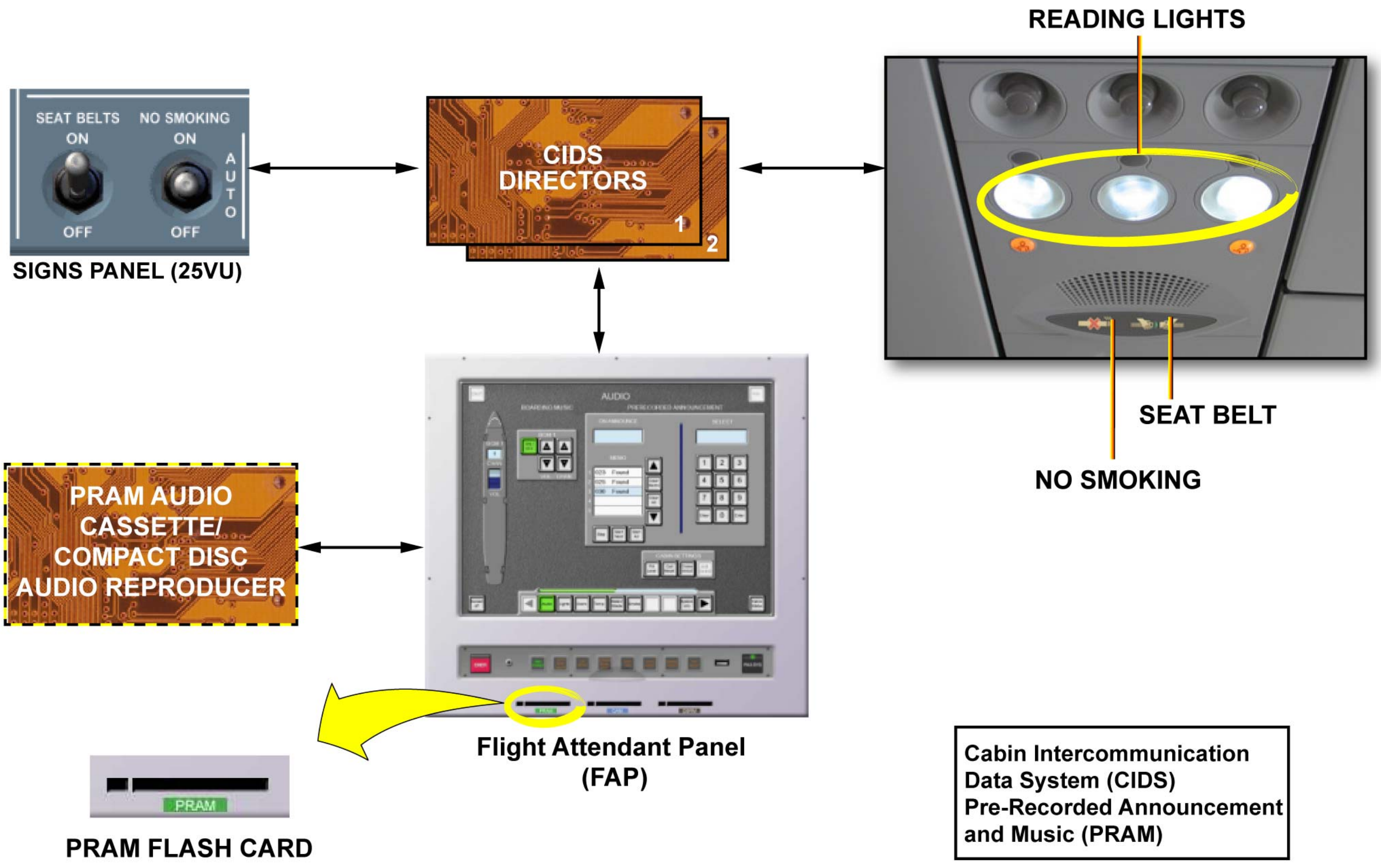
CABIN INTERCOMMUNICATION DATA SYSTEM

U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

PASSENGER ENTERTAINMENT AND SIGNS

"No smoking" and "fasten seat belt" signs are controlled from the cockpit. The FAP audio page provides controls and displays for the Pre-Recorded Announcement And Boarding Music (PRAM). The PRAM can be a flash card type, directly plugged into the FAP. An audio cassette/compact disc audio reproducer can also be installed.



PASSENGER ENTERTAINMENT AND SIGNS

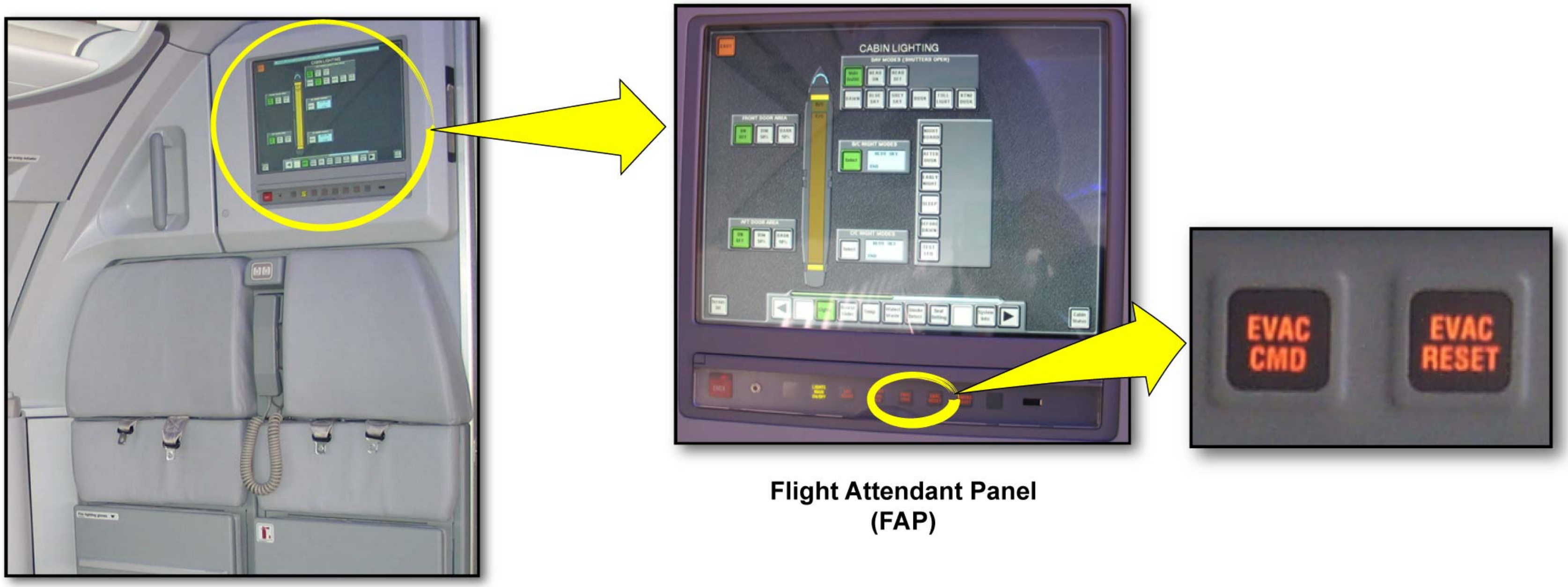
U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

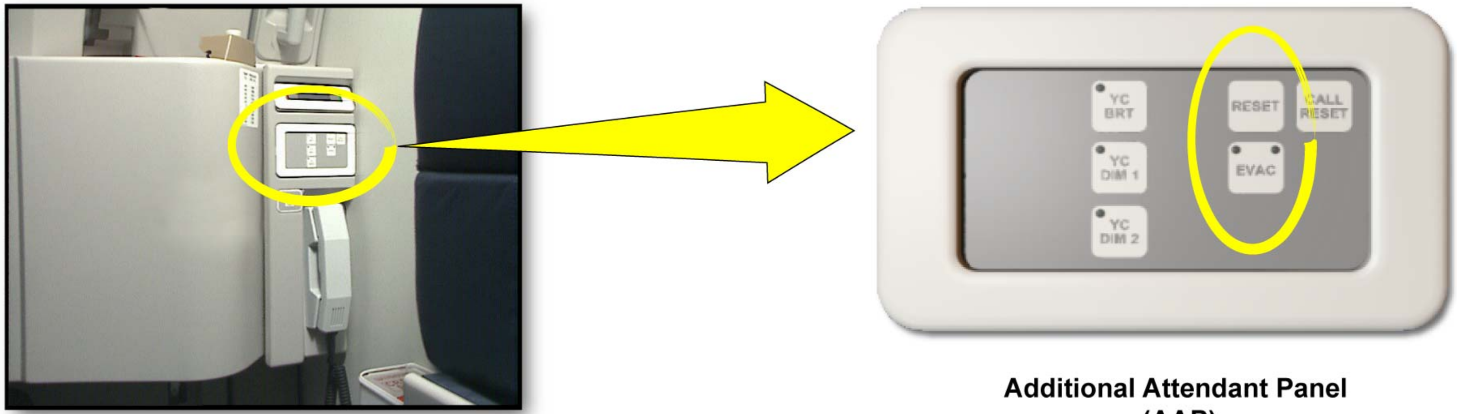
EVACUATION COMMAND SYSTEM

The emergency evacuation command may be activated from the cockpit, from the purser station, and optionally from the Additional Attendant Panel (AAP).
The EVAC signal can be reset from cockpit, FAP, AAP.
On the FAP, EVAC CMD and EVAC RESET P/Bs are located on the hard key panel to be available at any time irregardless of the FAP page presented.
On the EVAC panel located in the cockpit, the CAPT/CAPT & PURS selector switch, selects who is able to activate an EVAC ALERT.

U7Z08431 - U0OT4T0 - UM23PY000000002



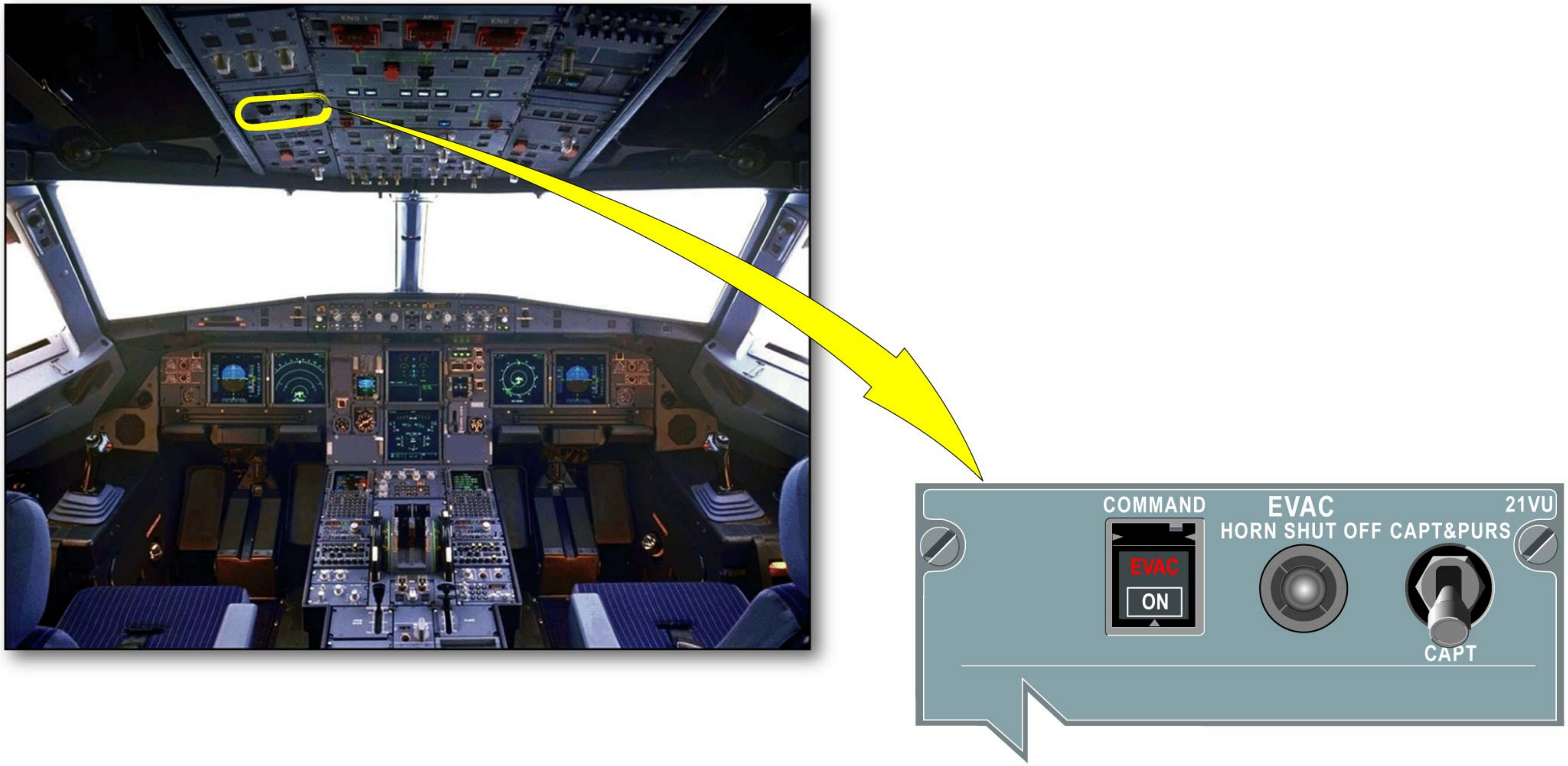
Flight Attendant Panel (FAP)



Additional Attendant Panel (AAP)

EVACUATION COMMAND SYSTEM

U7Z08431 - U0OT4T0 - UM23PY000000002



U7Z08431 - U0OT4T0 - UM23PY000000002

EVACUATION COMMAND SYSTEM

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23 CIDS SYSTEM PRESENTATION (1)

AIRCRAFT DATA MANAGEMENT

In the CIDS, the FAP displays the current cabin status on the CABIN STATUS page. The CIDS and related cabin systems are controlled and monitored from the FAP by its associated page.

U7Z08431 - U0OT4T0 - UM23PY000000002

AIRCRAFT DATA MANAGEMENT

U7Z08431 - U0OT4T0 - UM23PY000000002

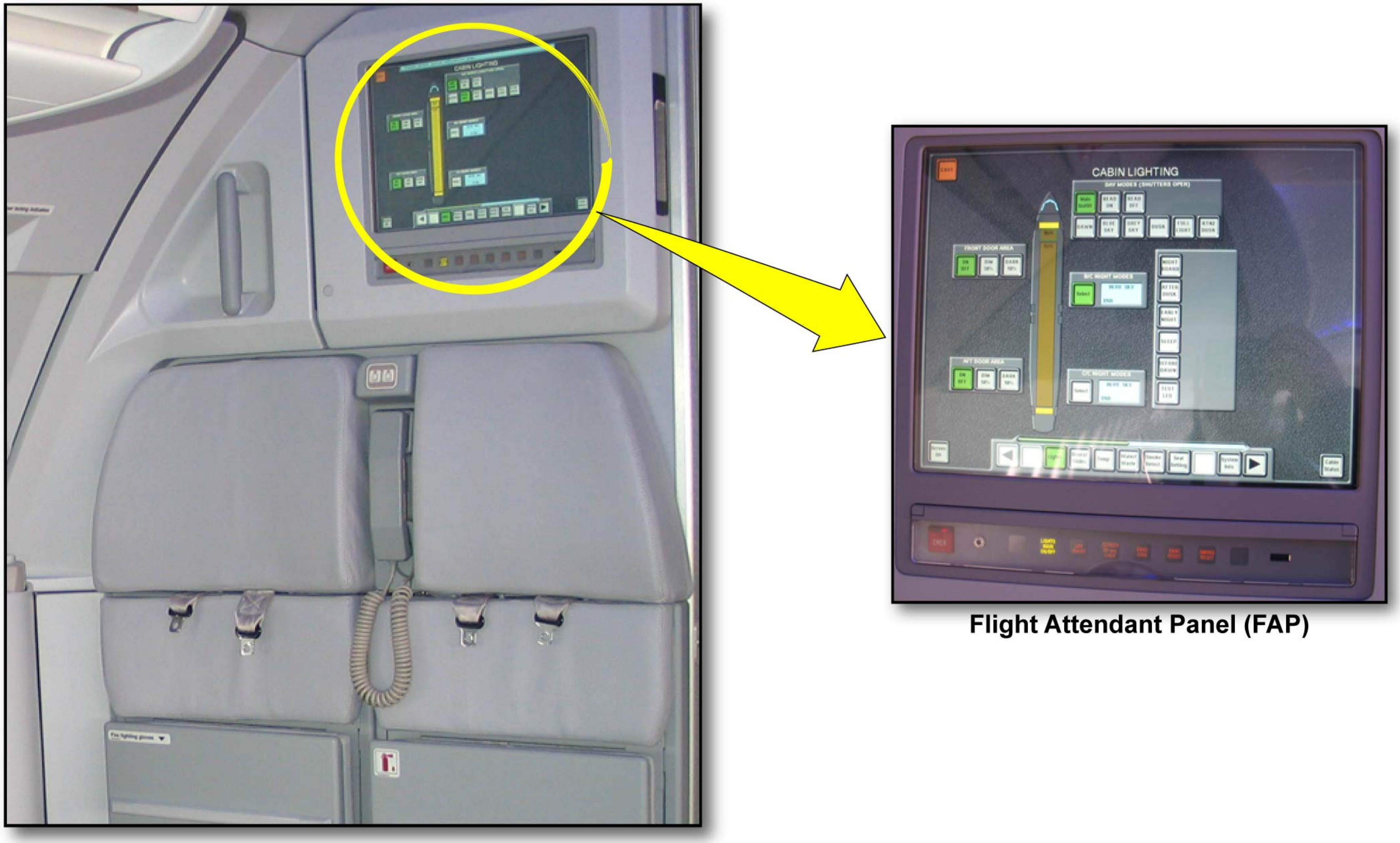
23 CIDS SYSTEM PRESENTATION (1)

CONTROL AND INDICATING

In this topic are described the purser station, the cabin crew station, and the area call panel.

PURSER STATION

The purser station is equipped with the FAP.
In the CIDS system, the functions are ensured by:
- the FAP for monitoring, control and testing,
- the MCDU for testing interface.



Flight Attendant Panel (FAP)

CONTROL AND INDICATING - PURSER STATION

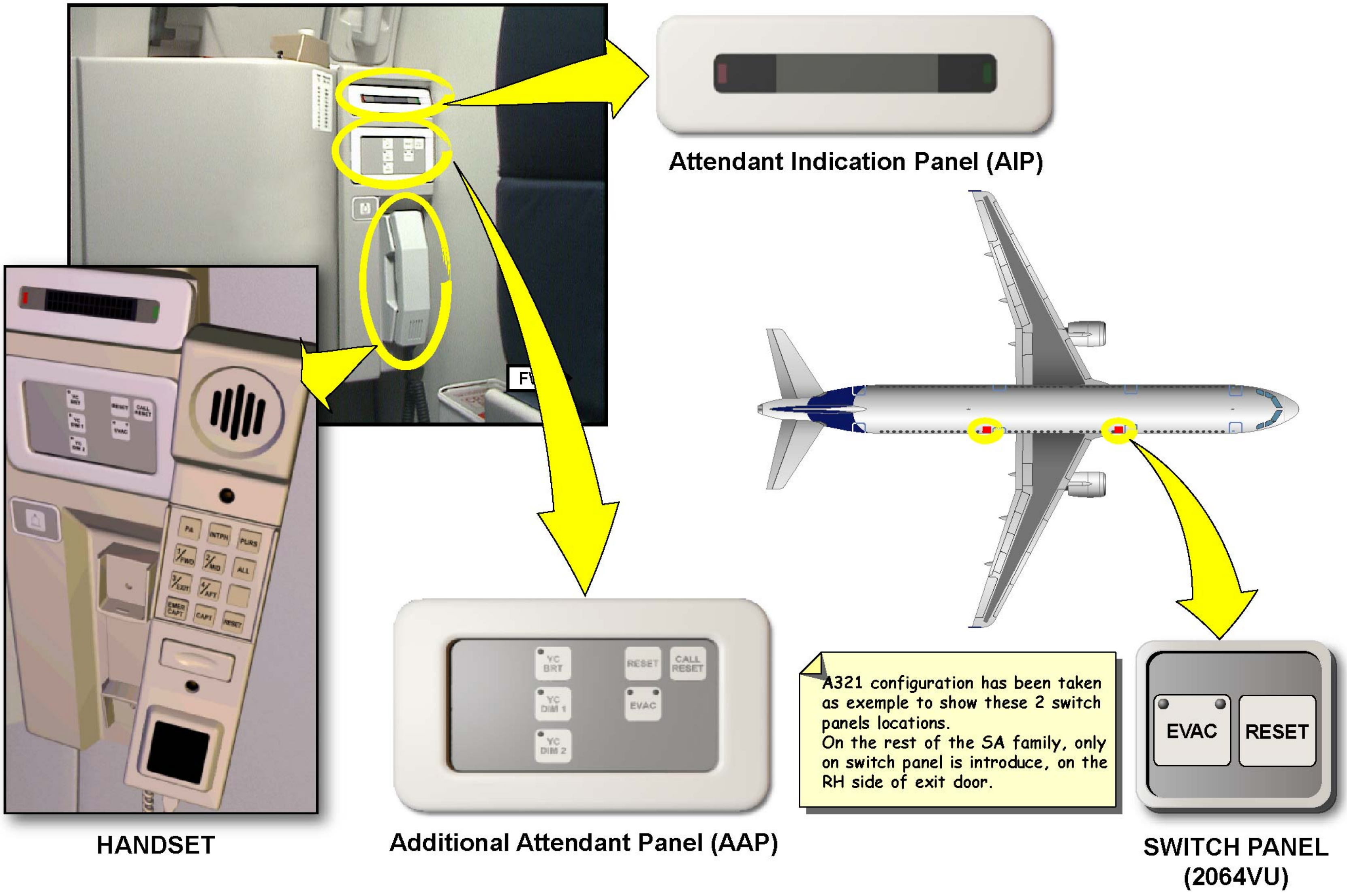
U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

CONTROL AND INDICATING (continued)

CABIN CREW STATION

Each crew station is equipped with:
- a handset,
- an Additional Attendant Panel (AAP),
- an Attendant Indication Panel (AIP),
- a switch panel, installed adjacent to the middle RH (A321) and exit RH (A318/319/320) attendant station.



CONTROL AND INDICATING - CABIN CREW STATION

U7Z08431 - U0OT4T0 - UM23PY000000002

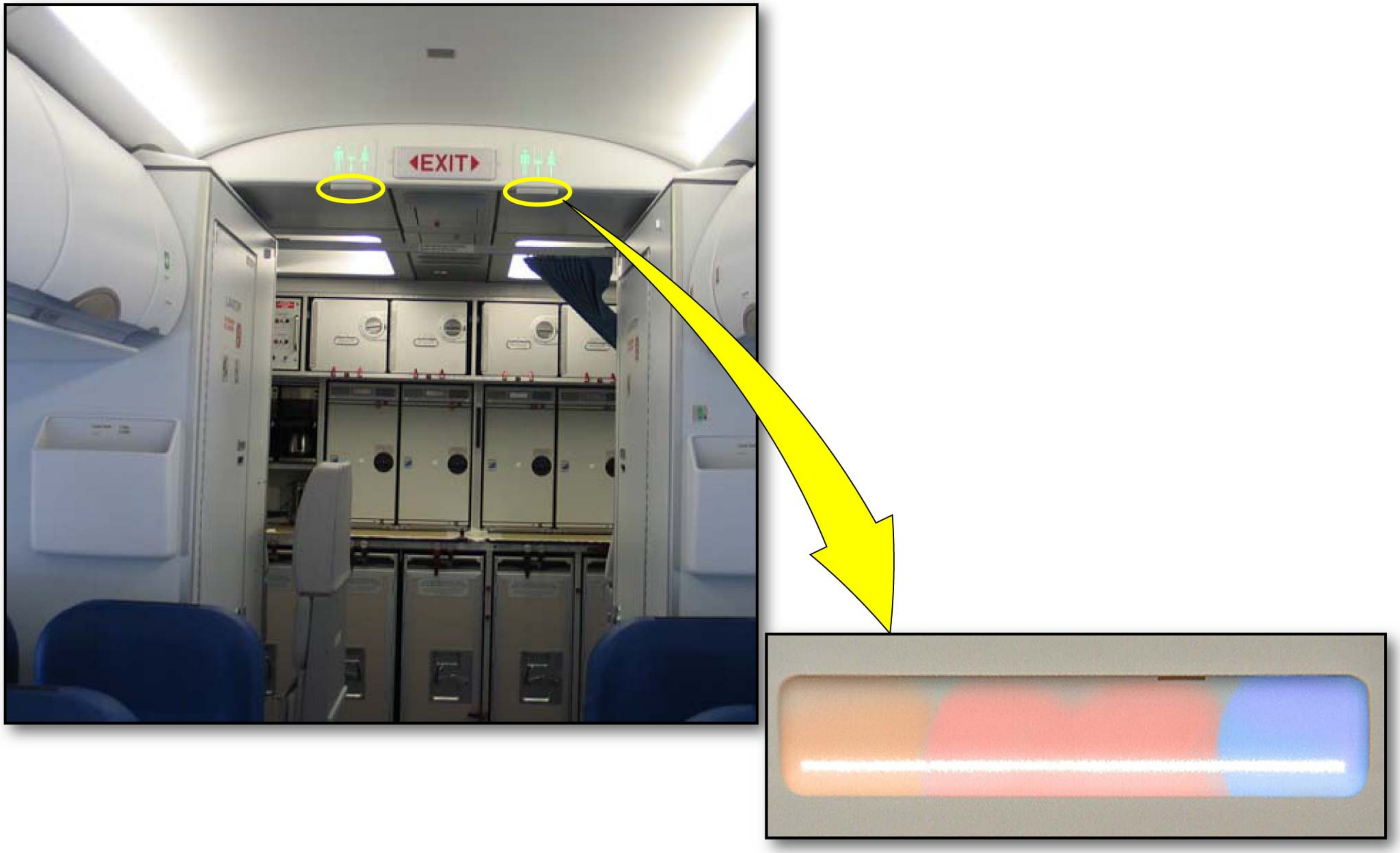
23 CIDS SYSTEM PRESENTATION (1)

CONTROL AND INDICATING (continued)

AREA CALL PANEL

The Area Call Panel (ACP) indicates:
- crew calls (pink steady or flashing),
- passenger call (blue steady),
- lavatory call (amber steady),
- lavatory smoke detection (amber flashing).

The ACPs are installed in the cabin ceiling at both ends of the passenger compartment.



CONTROL AND INDICATING - AREA CALL PANEL

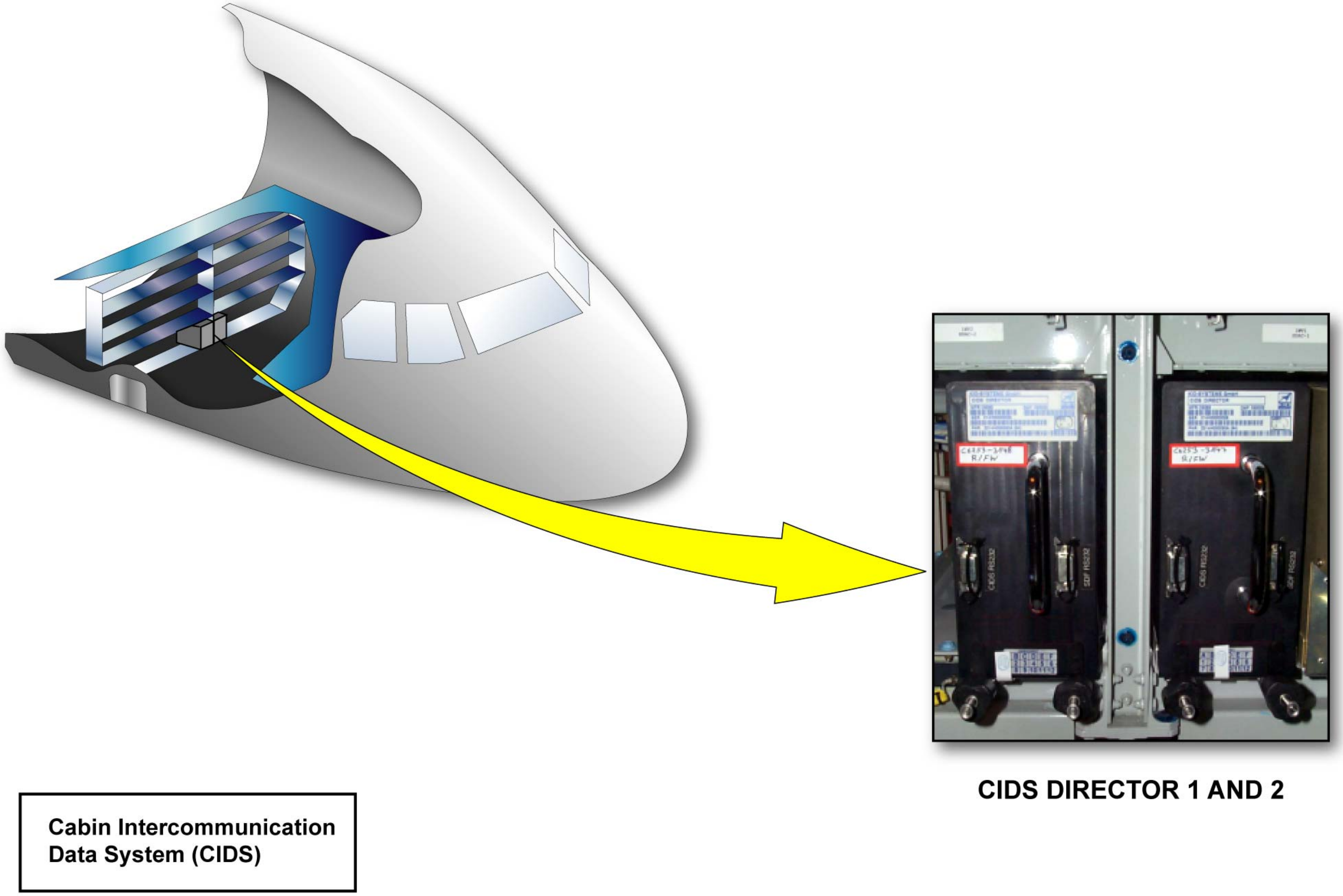
U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

COMPONENT LOCATION

CIDS DIRECTORS

The main components of the CIDS are the directors. Director 1 is active and director 2 is in hot standby, in normal operation.
In addition to the functions already listed, the directors manage the Vacuum System Control (VSC) function and the Smoke Detection Function (SDF).



COMPONENT LOCATION - CIDS DIRECTORS

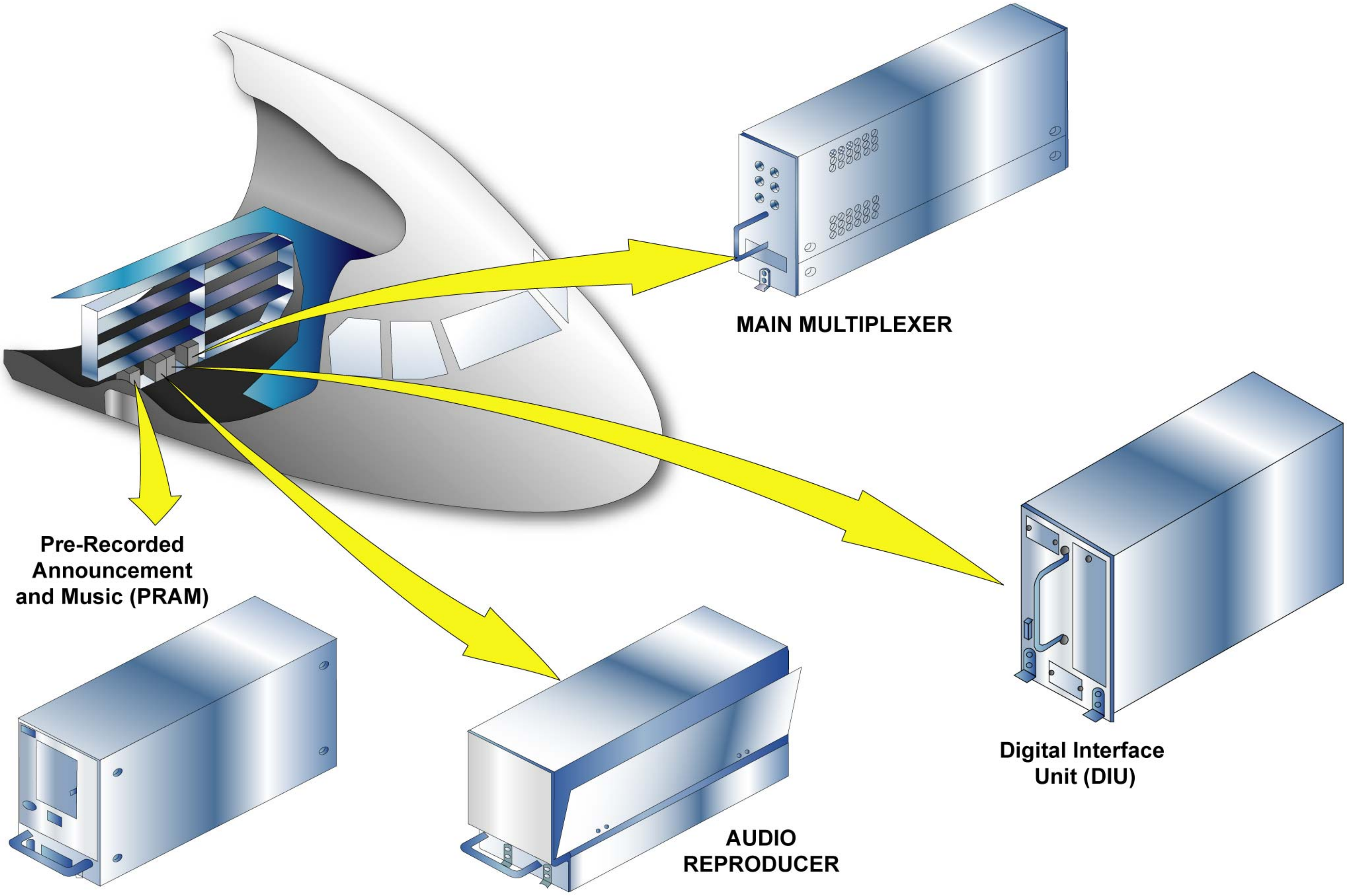
U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

PASSENGER ENTERTAINMENT SYSTEM

The passenger entertainment system is composed of the audio reproducer, the Digital Interface Unit (DIU) and the main multiplexer.



U7Z08431 - U0OT4T0 - UM23PY000000002

COMPONENT LOCATION - PASSENGER ENTERTAINMENT SYSTEM

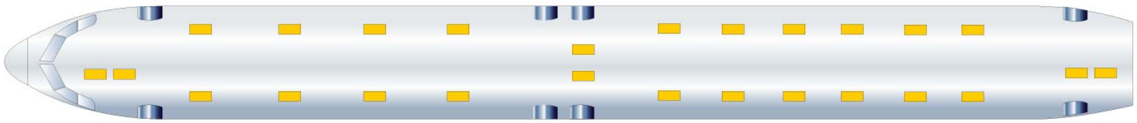
23 CIDS SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

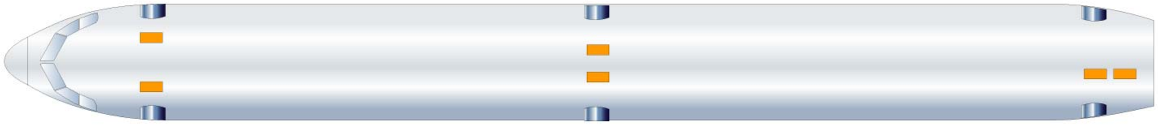
DECODER/ENCODER UNITS

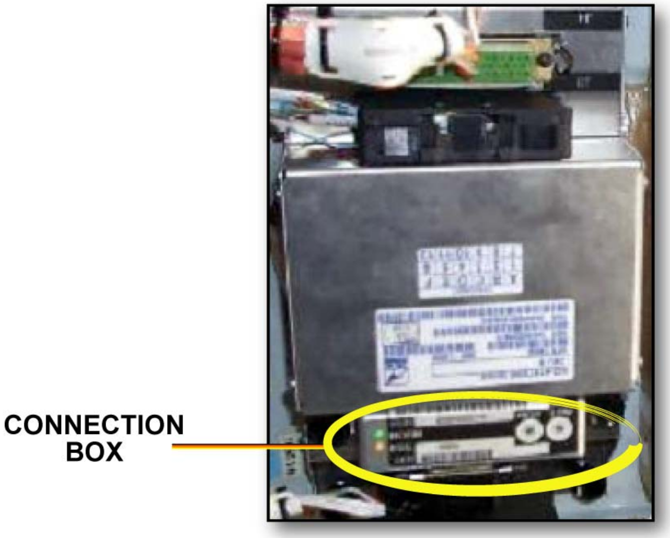
DEUs type A and B are located behind the ceiling panels. The number of DEUs installed depends on fuselage length and configuration of passenger entertainment systems. On the A321 for example, up to 32 DEU-A and 8 DEU-B may be installed. DEUs type A are not interchangeable with DEUs type B.

Decoder/Encoder Units (DEUs) A



Decoder/Encoder Units (DEUs) B





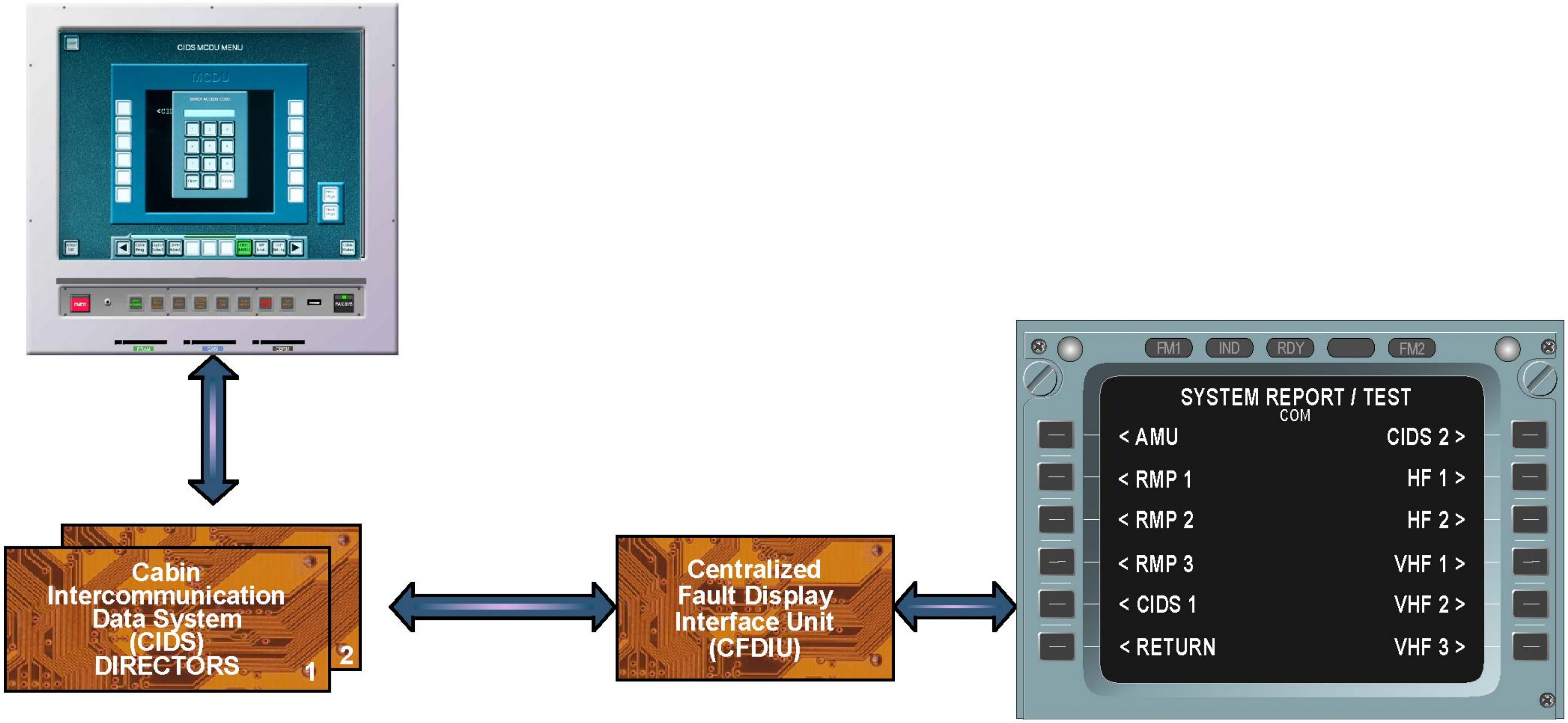
COMPONENT LOCATION - DECODER/ENCODER UNITS

U7Z08431 - U0OT4T0 - UM23PY000000002

23 CIDS SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The CFDS CIDS MENU page is accessible from the MCDU and from the FAP.



MAINTENANCE/TEST FACILITIES

23 CIDS SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on aircraft, make sure that you obey all the Aircraft maintenance Manual (AMM) safety procedures.
This will prevent injury to persons and/or damage to aircraft. Here is an overview of main safety precautions relative to the CIDS system.
Make sure that all circuits in maintenance are isolated before you apply electrical power to the aircraft. Unwanted electrical power can be dangerous.

NOTE: Note: You must be careful when you open the panels 2000VU or 2001VU as these are in a high voltage area.

Make sure that the warning notices are in position.
When you finish the work make sure that the work area is clean and clear of tools and other items.
Do not touch the lamp glass with your fingers. The oils from your skin will quickly cause deterioration of the lamp. If you accidentally touch the lamp glass, clean it with a lint-free cloth.

SAFETY PRECAUTIONS

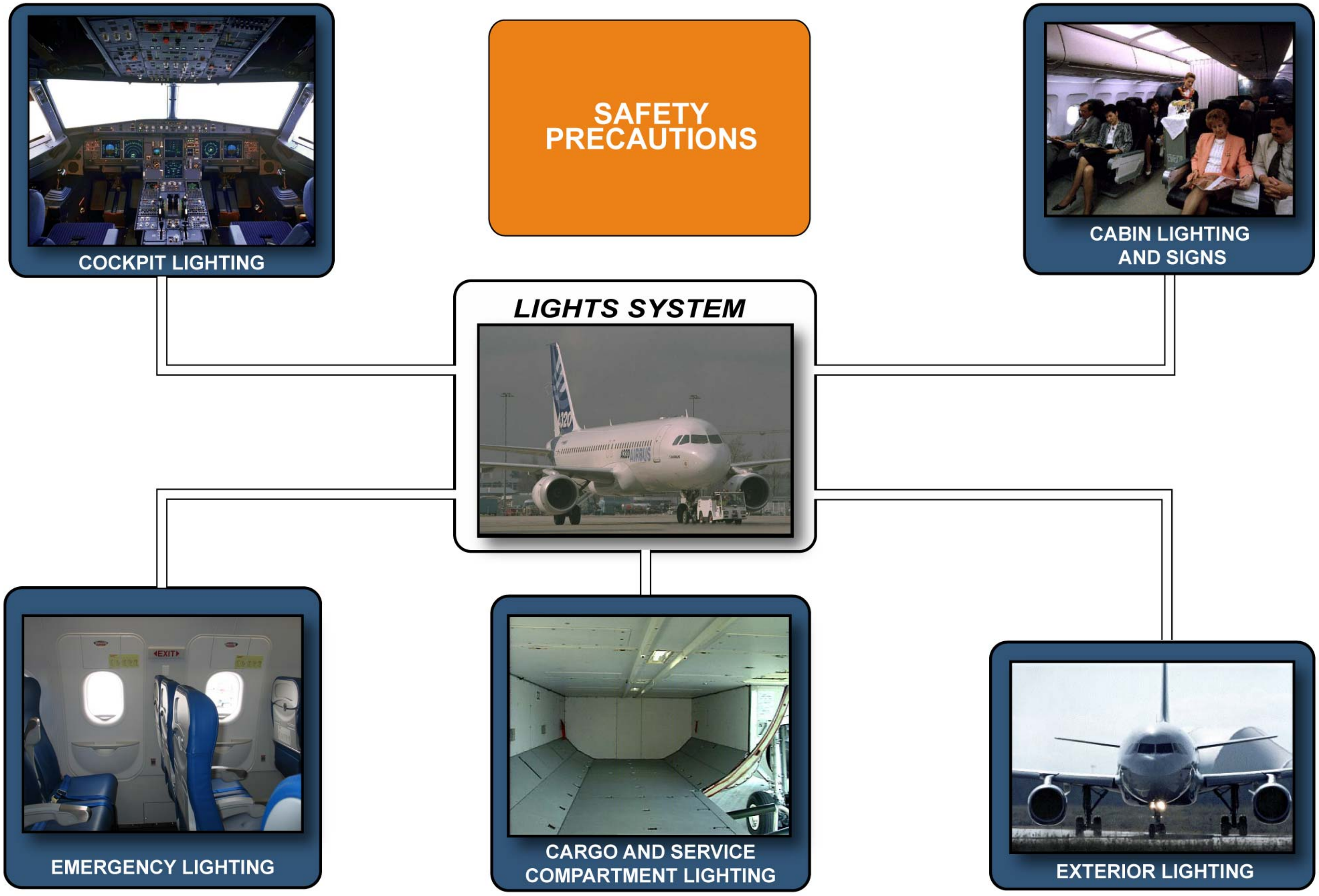
U7Z08431 - U0OT4T0 - UM23PY000000002

33 LIGHTS SYSTEM PRESENTATION (1)

GENERAL

The lighting system includes:
- cockpit lighting,
- cabin lighting and signs,
- emergency lighting,
- cargo and service compartment lighting,
- exterior lighting.

U7Z08431 - U0OT4T0 - UM33PZ000000002



GENERAL

U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

COCKPIT LIGHTS SYSTEM

The cockpit lighting system include:
- panel and instrument lighting,
- general cockpit lighting (dome light),
- ambient lighting.

COCKPIT LIGHTS CONTROL

The cockpit panels and instrument lighting controls are located:
- on three different panels,
- and underneath the glareshield.

The Captain and First Officer reading lights contain a potentiometer for brightness control and a slider for beam control.
The internal light panel contains the controls for the overhead panel integral lighting, standby compass integral light, the dome lights, and the annunciator lights.
Two potentiometers underneath the glareshield control the integral lighting of the glareshield and Flight Control Unit (FCU) displays.
The FLOOD LT potentiometers control the flood lights of their respective areas and the INTEG LT potentiometer, the main panel and pedestal lighting.
The side console light controls are on panels located on the left and right sides of the main instrument panel.

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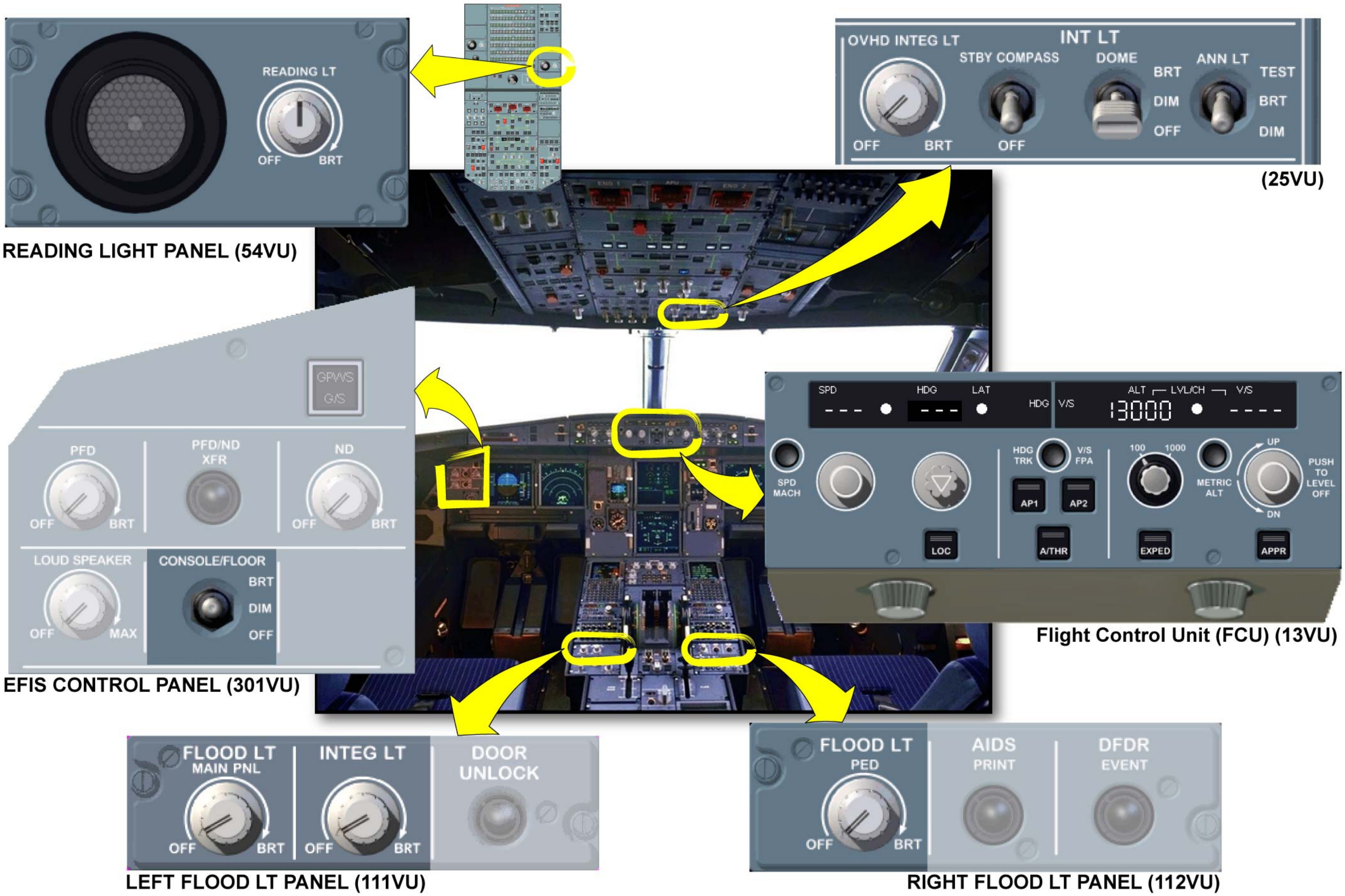


COCKPIT LIGHTS SYSTEM - COCKPIT LIGHTS CONTROL

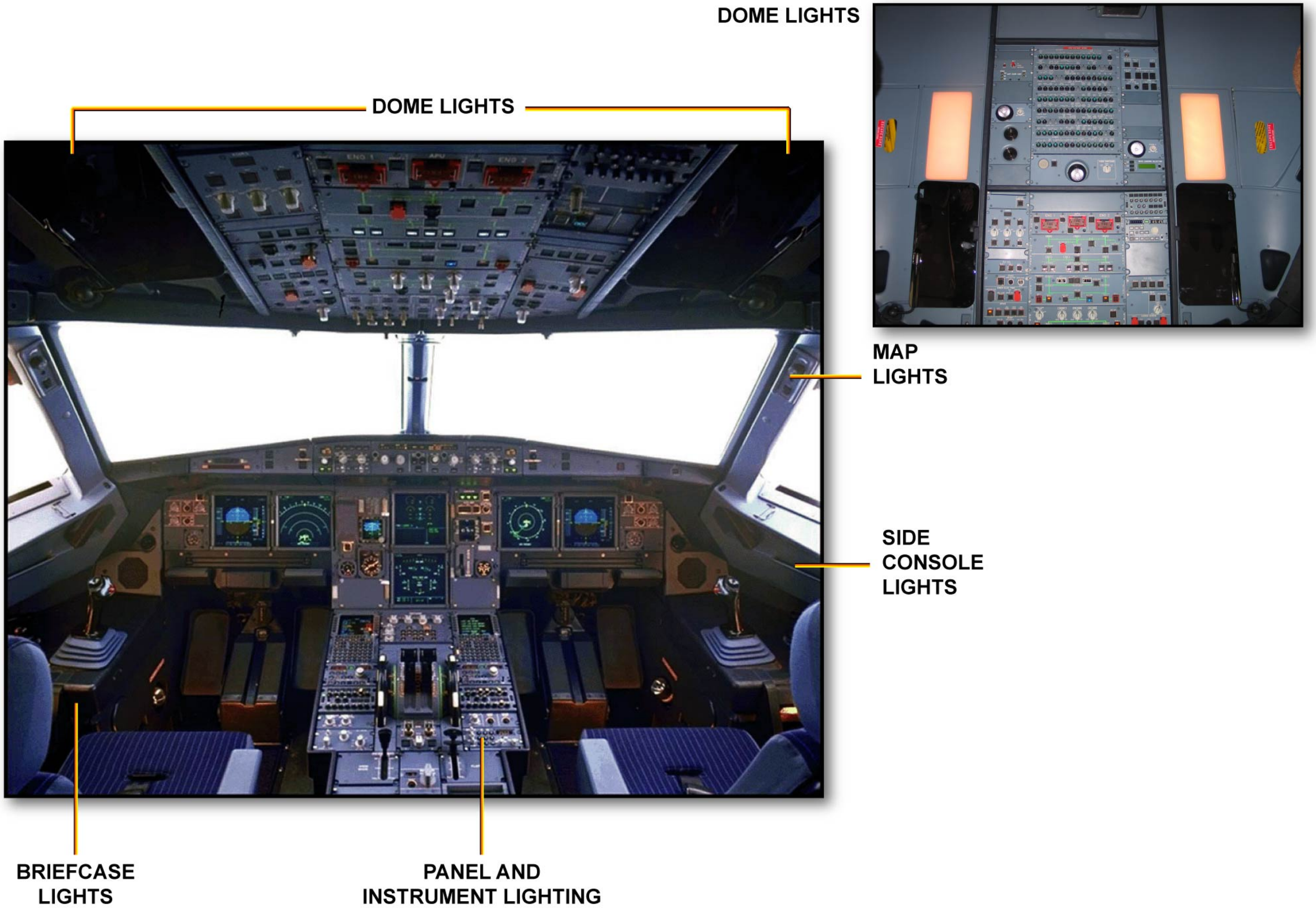
U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

COCKPIT LIGHTS SYSTEM (continued)

COCKPIT LIGHTS

The ambient lighting is supplied by:
- two reading lights installed on each side of the upper part of the overhead panel. Each reading light potentiometer controls the brightness of the corresponding supplementary reading light.
- Side console lights bring light to:
- the side consoles,
- briefcase areas,
- the floor around the pilot seats.
- Two map lights are also installed, one on each side of the cockpit.



COCKPIT LIGHTS SYSTEM - COCKPIT LIGHTS

U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

CABIN LIGHTS

CABIN LIGHTS THROUGH CIDS

Various cabin light and sign systems are controlled, tested, and monitored by the Cabin Intercommunication Data System (CIDS). The CIDS includes two directors, the Flight Attendant Panel (FAP), and the DEUs. The touch screen FAP controls and indicates the status of the CIDS. Integrated within the FAP are Cabin Assignment Module (CAM), On Board Replaceable Module (OBRM) and Prerecorded Announcement and Music (PRAM) in flash card format.
The director communicates through Decoder Encoder Units (DEUs) with the cabin, passenger and crew systems.

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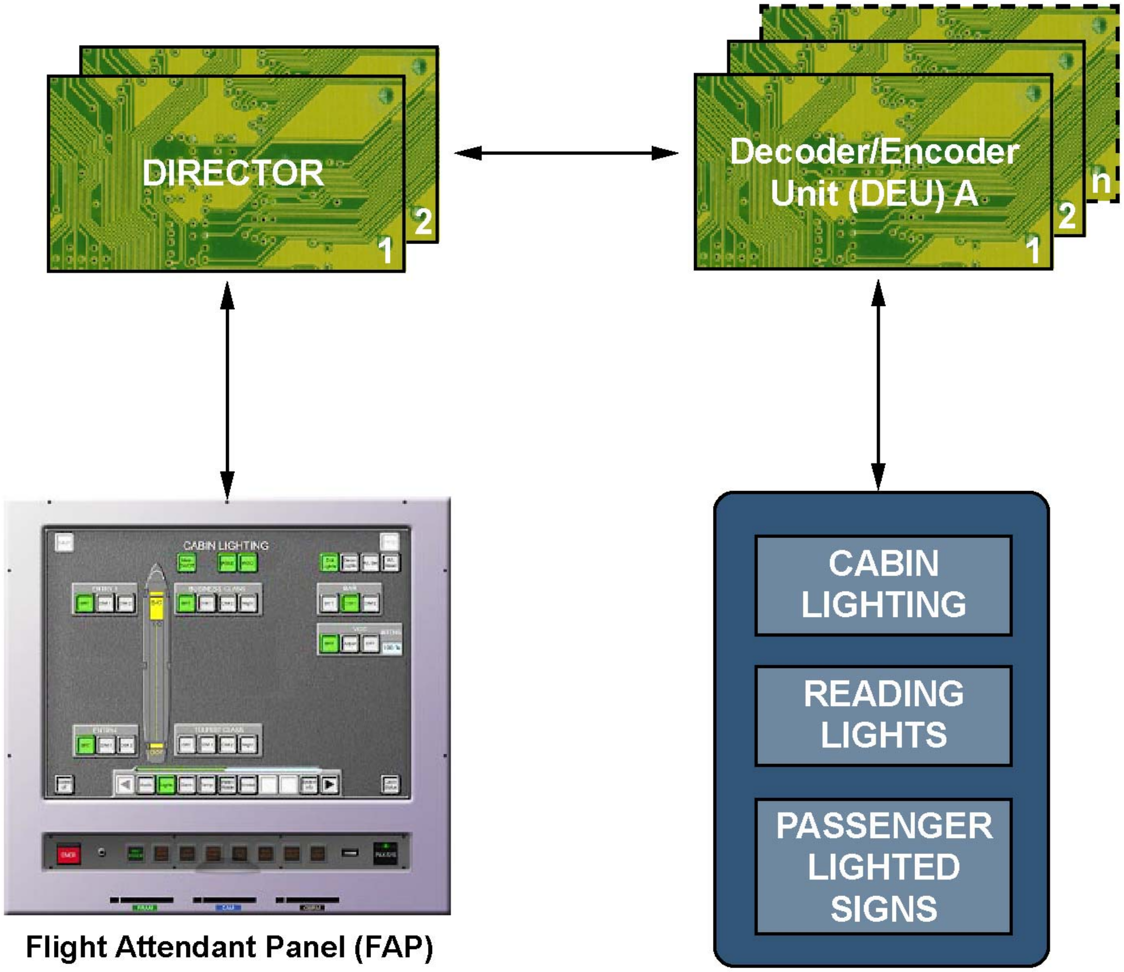


CABIN LIGHTS - CABIN LIGHTS THROUGH CIDS

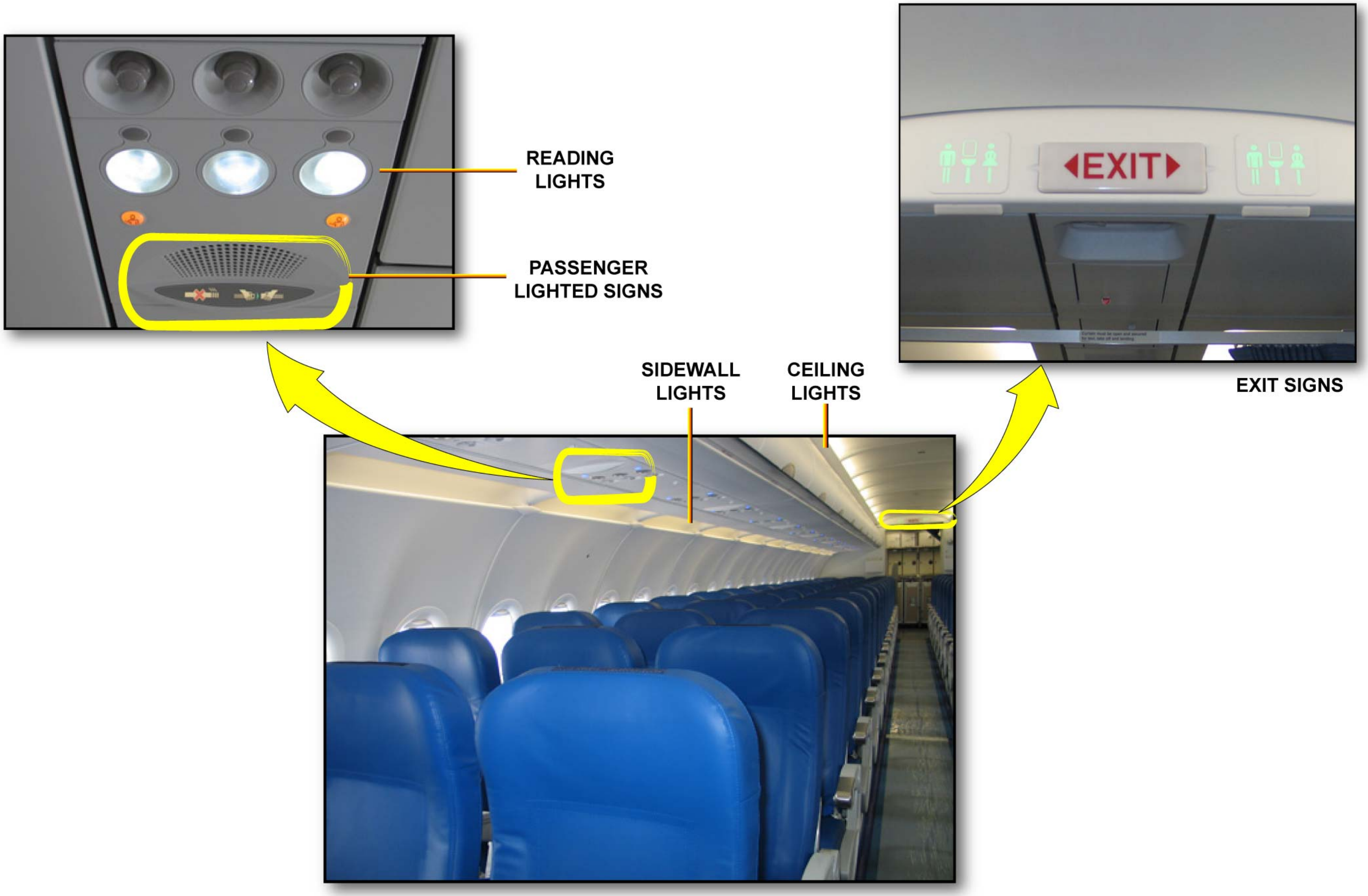
U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

CABIN LIGHTS (continued)

CABIN LIGHTS AND SIGNS

The CIDS controls and monitors the cabin lights through the FAP.
The CIDS also controls:
- the passenger lighted signs,
- the passenger reading lights,
- the passenger calls.



CABIN LIGHTS - CABIN LIGHTS AND SIGNS

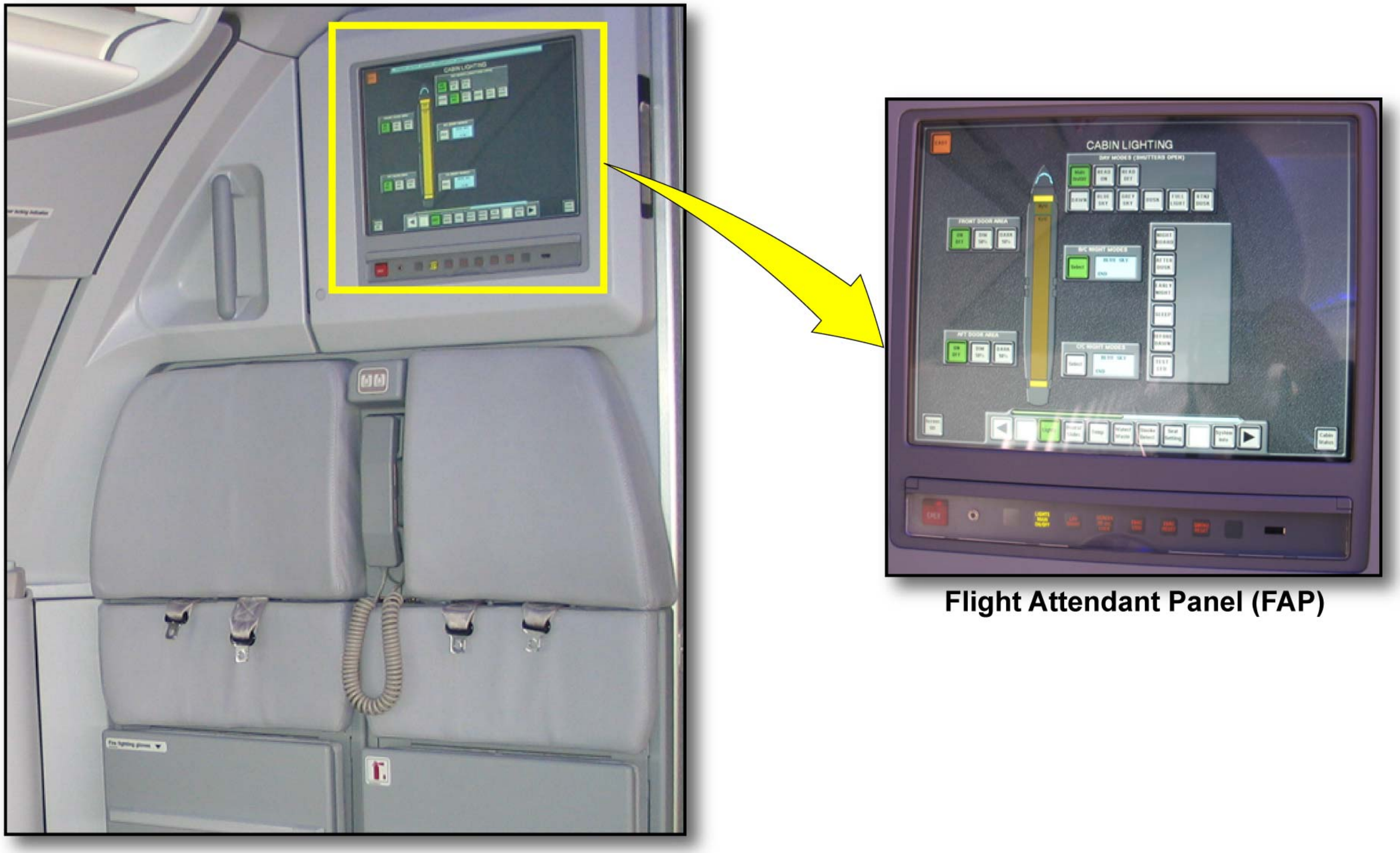
U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

CABIN LIGHTS (continued)

PURSER STATION

The FAP is located at the purser station. The FAP display structure is made of different pages related to the different systems connected to the CIDS.
The FAP is used for monitoring, control and testing. The MCDU provides a testing interface.



CABIN LIGHTS - PURSER STATION

U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

EMERGENCY LIGHTS

Emergency lights are installed in the cabin and on the exterior fuselage for overwing emergency exits.
The cabin emergency lights are lamps located on the cabin ceiling panels. In order to provide sufficient lighting of the aisle, exits and emergency exits, lights are installed on the left aisle seats and near the passenger doors and wing exits.
The exterior emergency lights come on automatically whenever the escape slide is deployed. The lights are supplied from the cabin emergency power supply units.

CONTROL AND INDICATING

The emergency-lighting system can be controlled by the control switch EMER EXIT LT installed on the overhead cockpit control panel.
The red EMERgency pushbutton has the same function as the cockpit EMER EXIT LT switch in the ON position.

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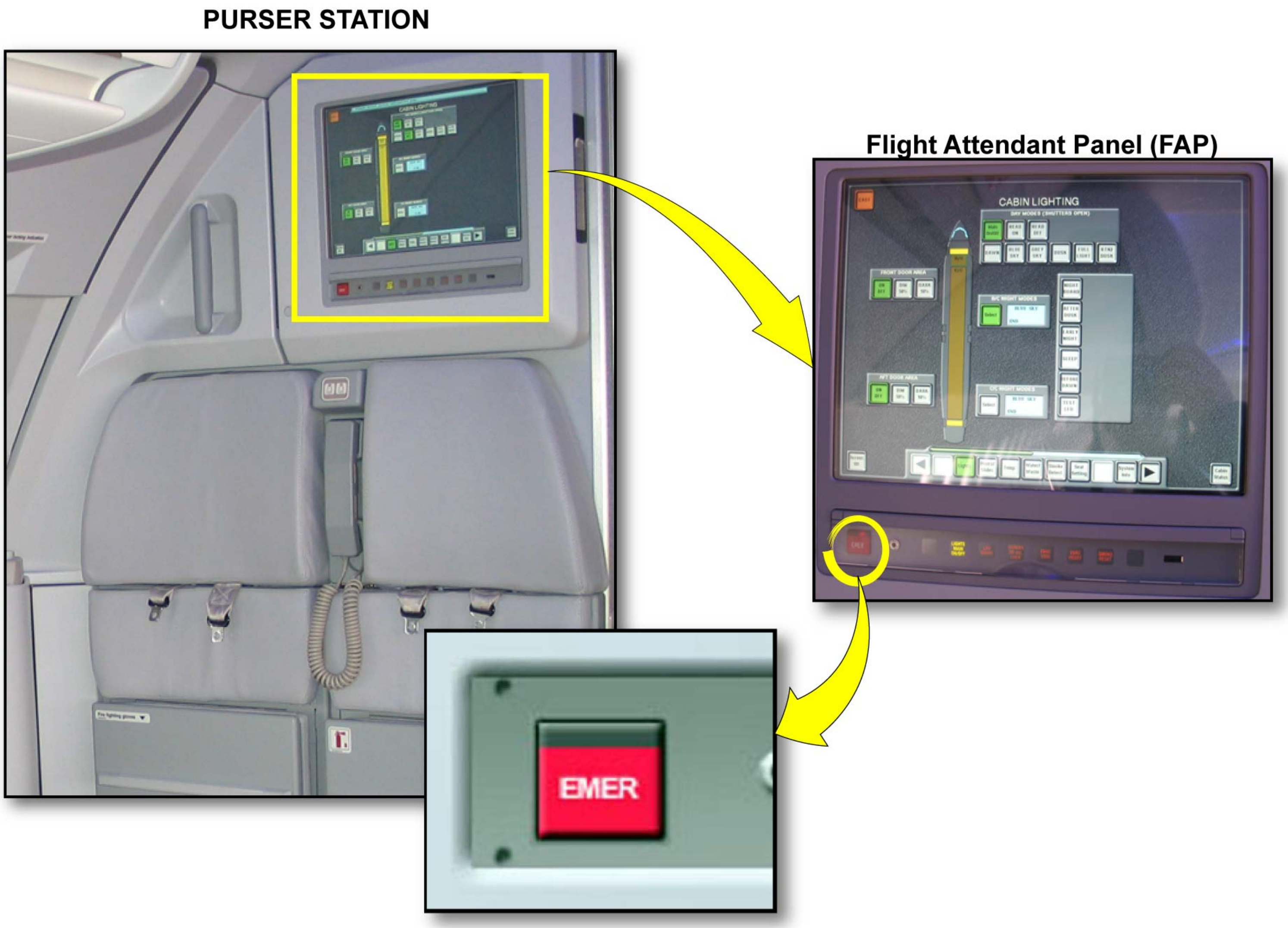
U7Z08431 - U0OT4T0 - UM33PZ000000002

EMERGENCY LIGHTS - CONTROL AND INDICATING



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EMERGENCY LIGHTS - CONTROL AND INDICATING

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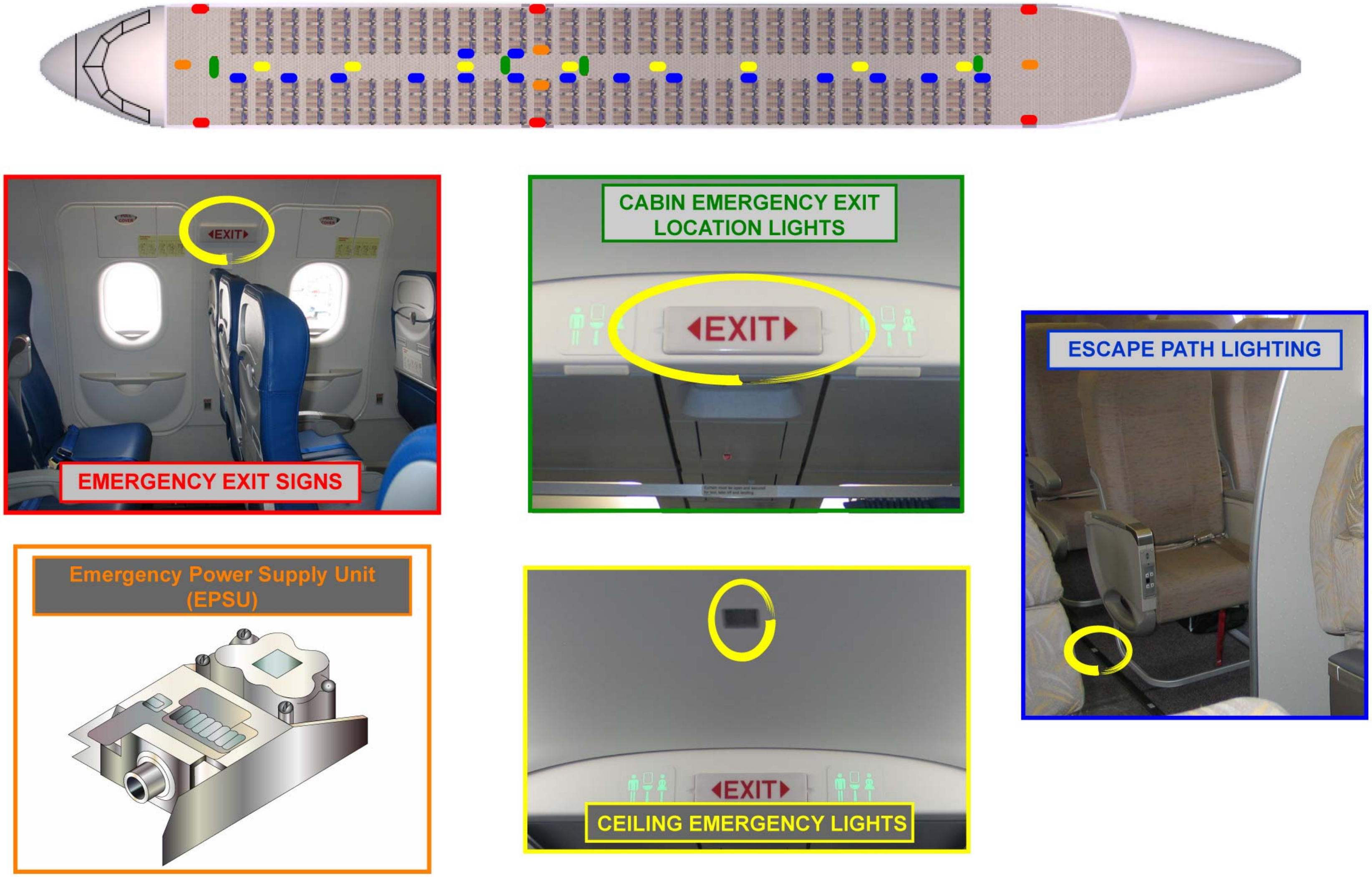
33 LIGHTS SYSTEM PRESENTATION (1)

EMERGENCY LIGHTS (continued)

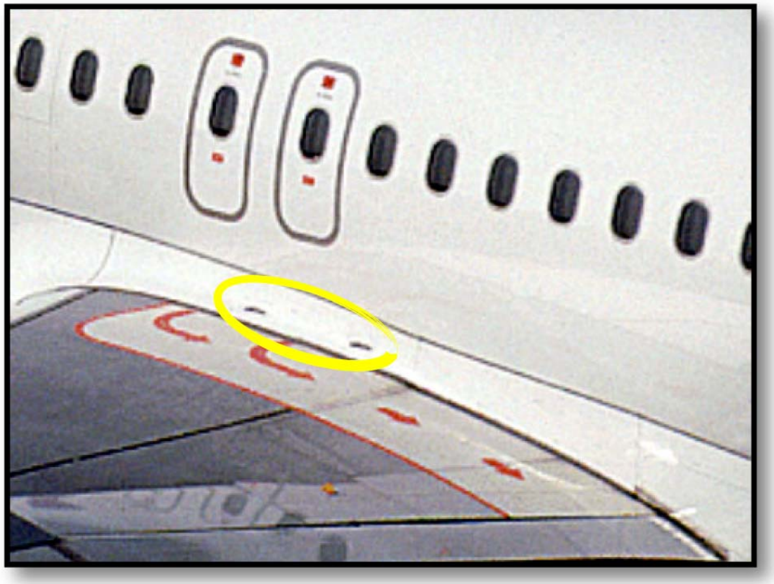
COMPONENT LOCATION

Emergency lights in the cabin include EMERGENCY EXIT signs, Ceiling EMERGENCY lights, ESCAPE PATH lighting, The emergency lights are supplied by several Emergency Power Supply Units (EPSUs).
Housed in the fuselage, there are 4 exterior emergency lights. These lights are automatically activated when an overwing emergency exit door is opened in the armed configuration. The lights come on all along the escape route leading to the aft wing slide. Each escape slide has integrated lighting strips.

U7Z08431 - U0OT4T0 - UM33PZ000000002



EMERGENCY LIGHTS - COMPONENT LOCATION



EMERGENCY LIGHTS - COMPONENT LOCATION

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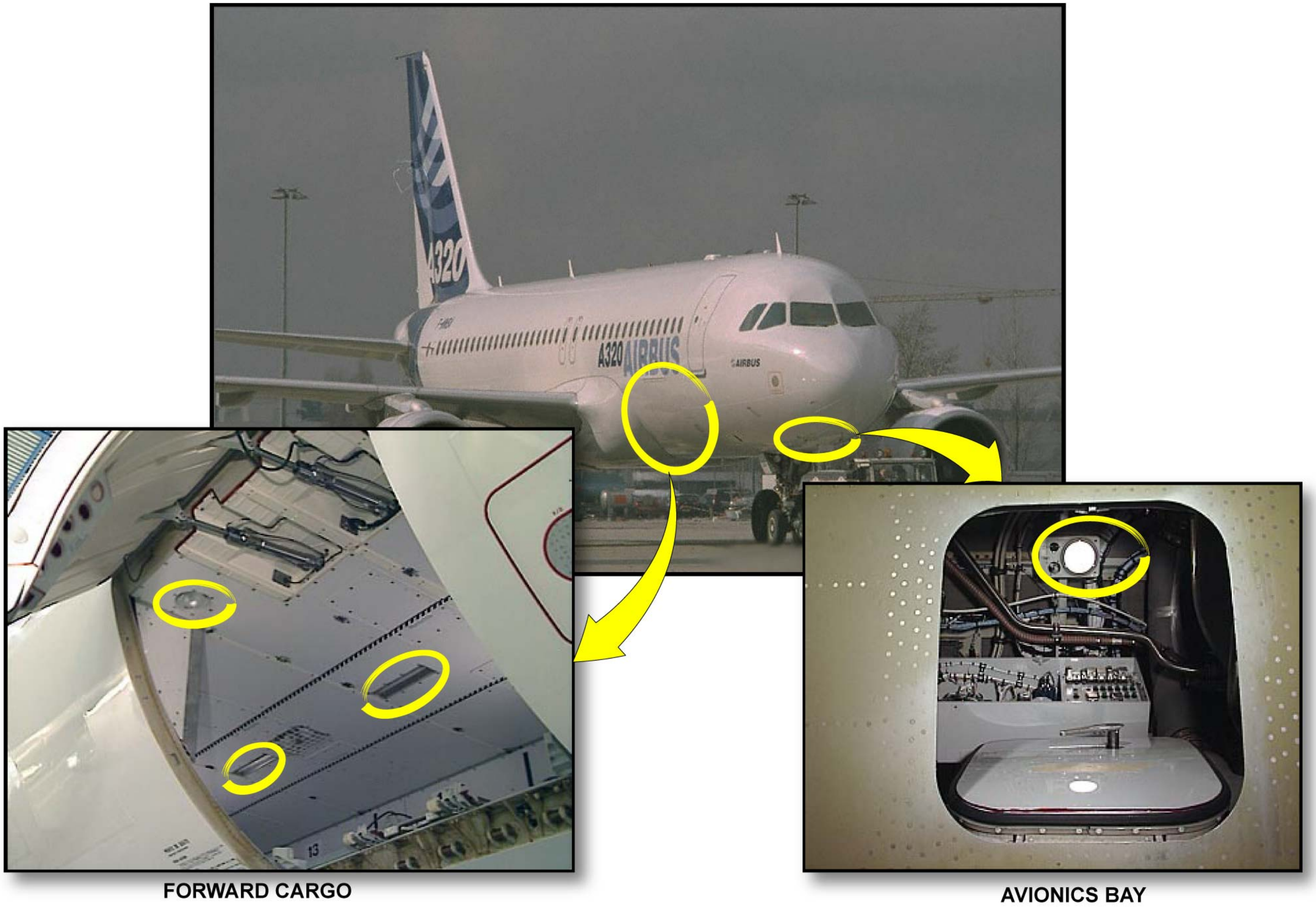
33 LIGHTS SYSTEM PRESENTATION (1)

CARGO AND SERVICE COMPARTMENT LIGHTS

The graphic shows the different cargo and avionics compartment lights.

U7Z08431 - U0OT4T0 - UM33PZ000000002



CARGO AND SERVICE COMPARTMENT LIGHTS

U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

EXTERIOR LIGHTS

CONTROLS

The controls for all external lights are on the EXT LT panel located on the overhead panel.

EXTERIOR LIGHTS - CONTROLS

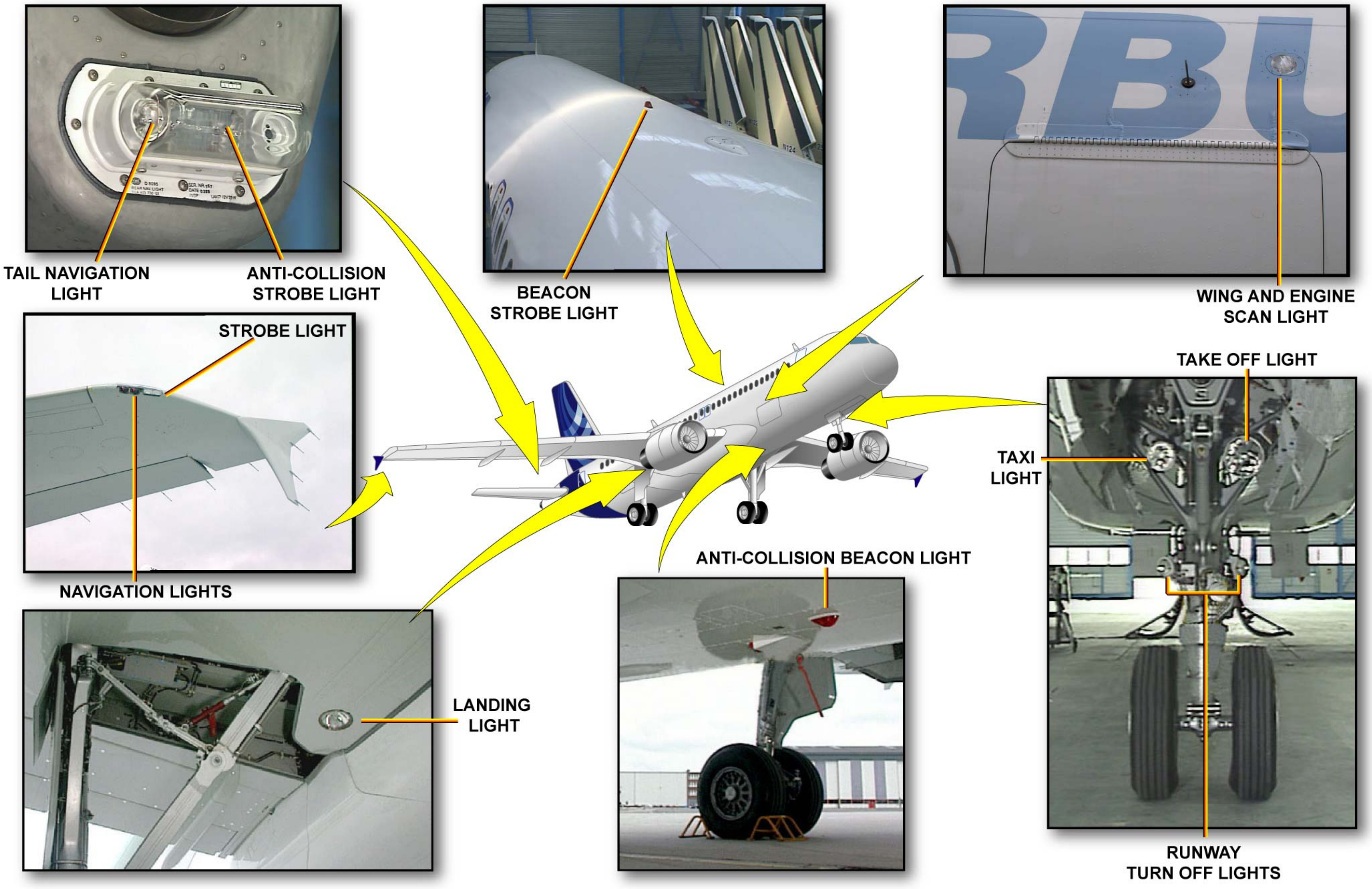
U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

EXTERIOR LIGHTS (continued)

COMPONENT LOCATION

The exterior lighting system include:
- taxi, turn off lights,
- navigation, strobe, beacon, wing lights,
- take off and landing lights.



EXTERIOR LIGHTS - COMPONENT LOCATION

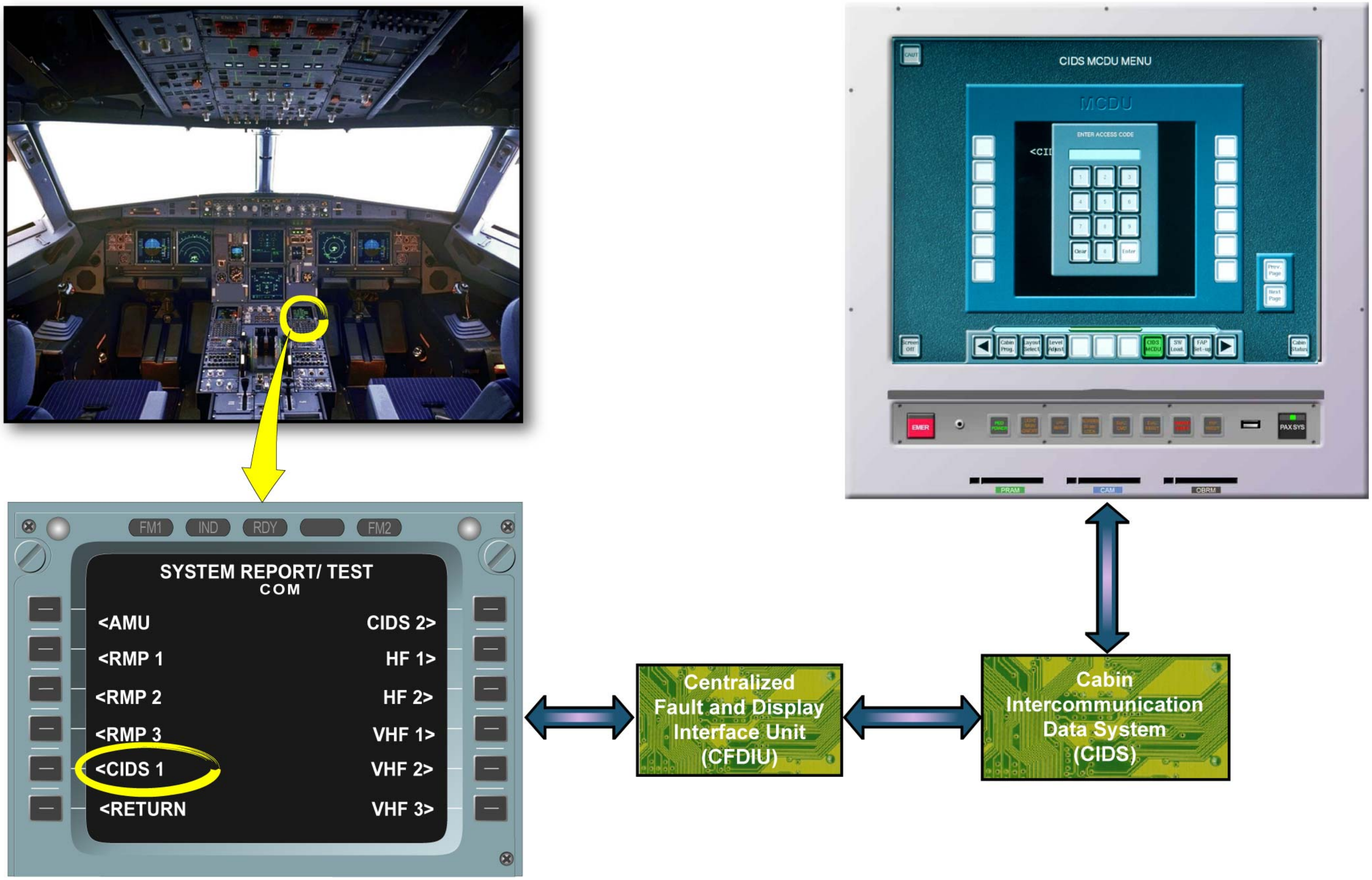
U7Z08431 - U0OT4T0 - UM33PZ000000002

33 LIGHTS SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The CIDS related lights system can be monitored and tested via the MCDU.
The CIDS BITE is accessible from the MCDU through the Centralized Fault Display Interface Unit (CFDIU) or from the FAP, like it is possible on the MCDU in the cockpit. This page is protected by a password.

U7Z08431 - U0OT4T0 - UM33PZ000000002



MAINTENANCE/TEST FACILITIES

U7Z08431 - U0OT4T0 - UM33PZ000000002

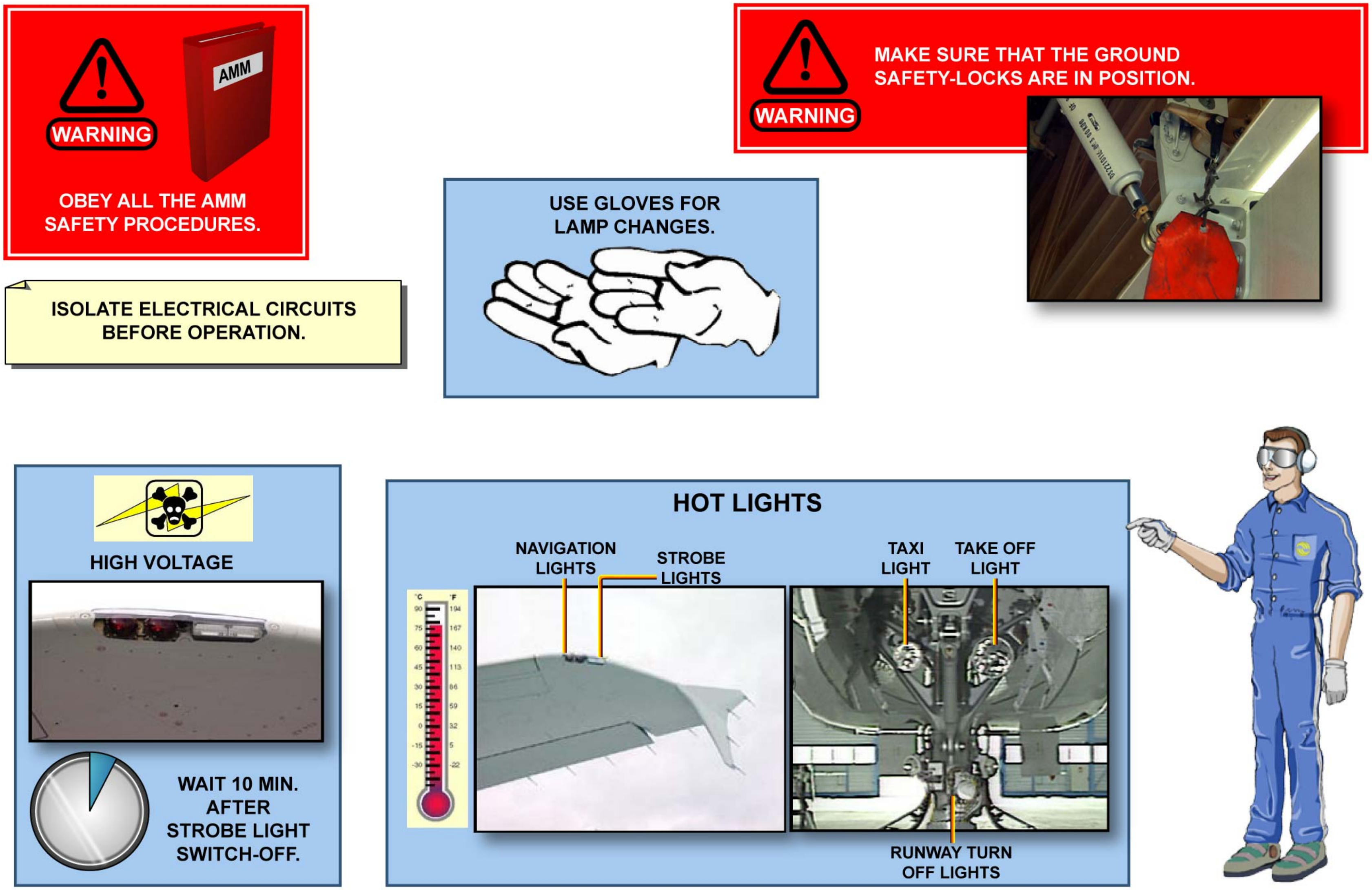
33 LIGHTS SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on the lights system, make sure that you obey all the Aircraft maintenance Manual (AMM) safety procedures. This will prevent injury to persons and/or damage to the aircraft. Here is an overview of main safety precautions related to the lights system.
Isolate the electrical circuits from the related equipment and the environment to prevent injury to persons and/or aircraft damage.
Do not disconnect the electrical connections for at least two minutes after you de-energize the electrical circuits.
When you change a lamp, do not touch the glass with your fingers. The oils from your skin will quickly cause deterioration of the lamp. If you accidentally touch the lamp glass, clean it with a lint-free cloth.
Do not look directly towards the lights without eyes protection. Their intensity can be high enough to cause permanent damage to your eyes.
Make sure that there are no signs of fuel contamination in the landing light assembly. If you find fuel contamination, no person must operate the landing light until:
- you repair the fuel leak,
- you replace the landing light assembly.

If you do not obey this precaution, ignition of the remaining fuel in the landing light can occur.
Put the safety devices and the warning notices in position before you start a task on or near:
- the flight controls,
- the flight control surfaces,
- the landing gear and the related doors,
- components that move.

Do not remove a strobe light for at least ten minutes after you de-energize the electrical circuits. The high voltage electrical current in the capacitor of the strobe light is dangerous.
Do not touch the strobe lights for at least 5 minutes after operation. The strobe light will still be hot. Use gloves when removing lamps, oils from your skin can deteriorate the life of the bulbs.
Be careful if you touch the strobe light with the cover removed and the power on. Some components have dangerous voltages.



SAFETY PRECAUTIONS

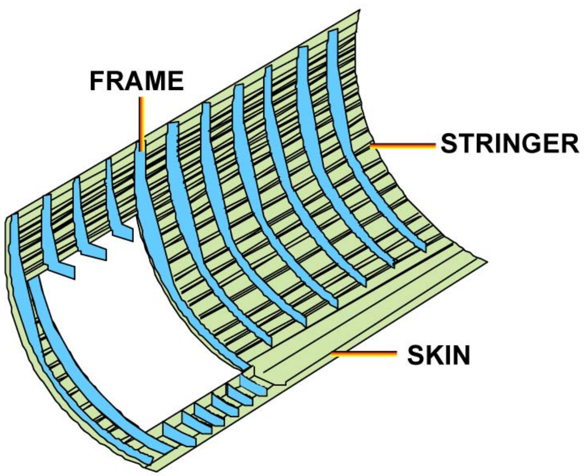
51 STRUCTURE PRESENTATION (1)

STRUCTURE DESIGN PRINCIPLES

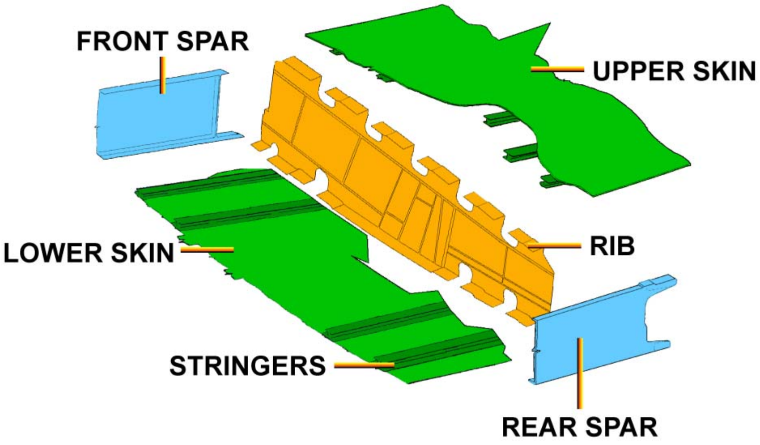
Four typical principles are used in the aircraft design:
- for the fuselage, the skin is attached to the frames and stiffened by stringers,
- for the boxes, the skins stiffened with stiffeners are attached to spars and ribs,
- the composite parts could be monolithic or sandwich construction.

METALIC

FUSELAGE STRUCTURE PRINCIPLE

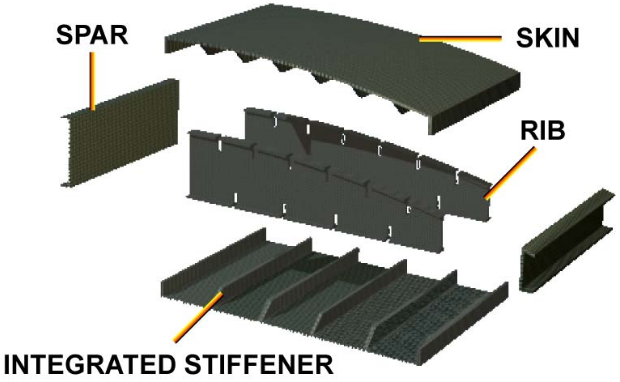


WINGBOX STRUCTURE PRINCIPLE

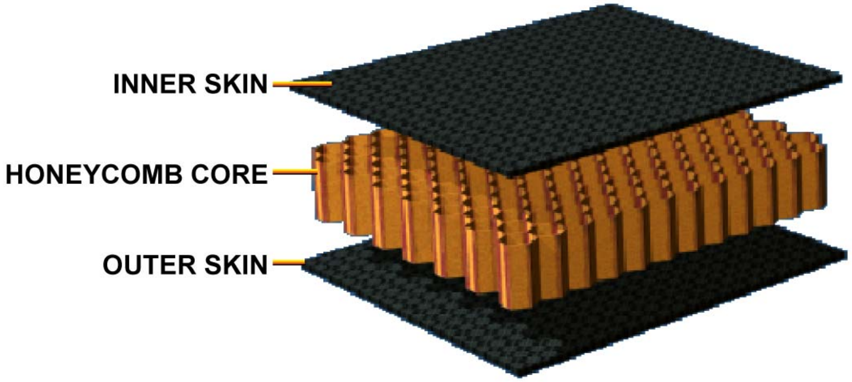


COMPOSITE

MONOLITHIC SKIN



SANDWICH PART STRUCTURE PRINCIPLE



STRUCTURE DESIGN PRINCIPLES

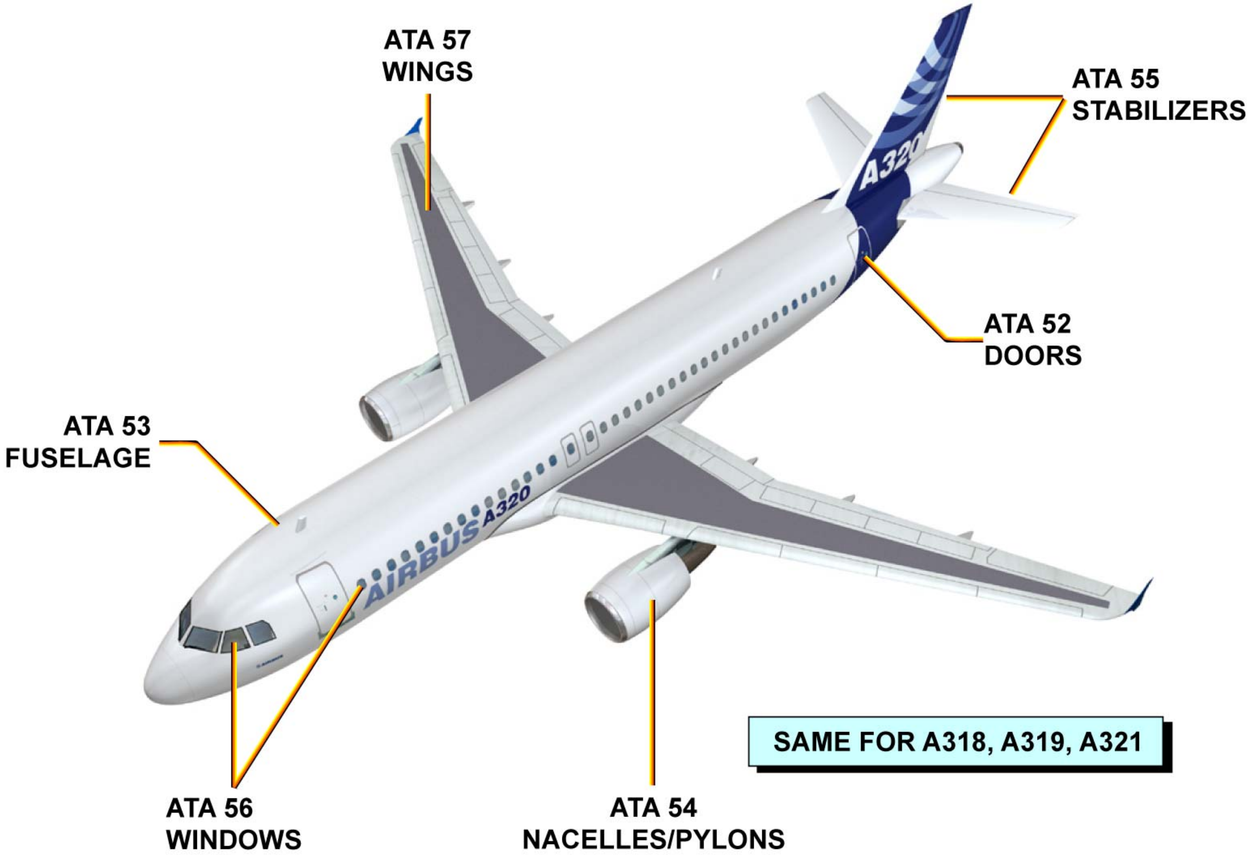
U7Z08431 - U0OT4T0 - UM51PZ000000001

51 STRUCTURE PRESENTATION (1)

STRUCTURE ATA BREAKDOWN

The structure of the aircraft is broken down as follows:
ATA 52 for the doors,
ATA 53 for the fuselage,
ATA 54 for the pylons,
ATA 55 for the stabilizers,
ATA 56 for the windows,
ATA 57 for the wings.

U7Z08431 - U0OT4T0 - UM51PZ000000001



STRUCTURE ATA BREAKDOWN

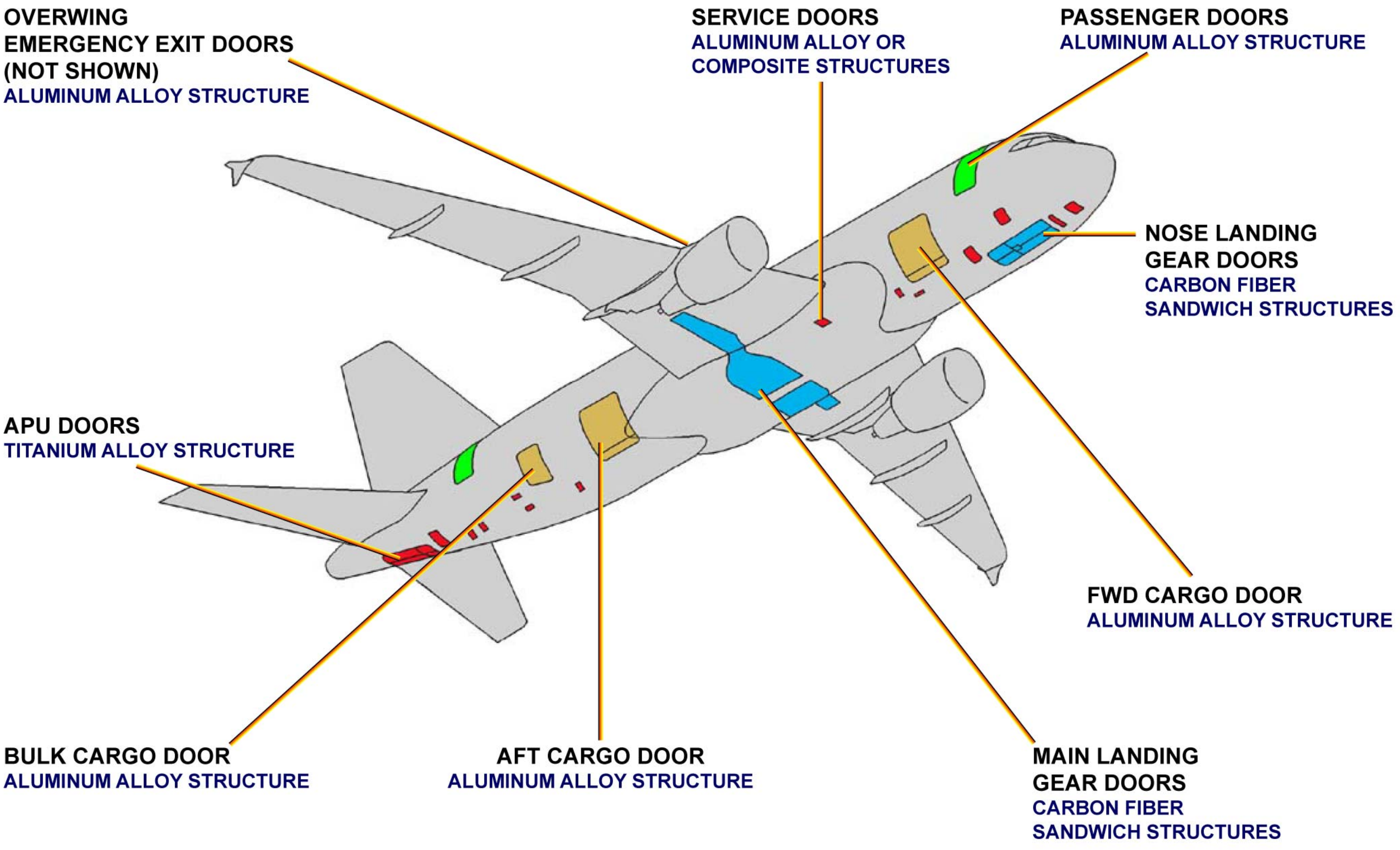
U7Z08431 - U0OT4T0 - UM51PZ000000001

51 STRUCTURE PRESENTATION (1)

DOORS

The passenger/crew doors and the emergency exit doors are of same aluminum alloy design comprising skins, edge members, horizontal beams and vertical frames.
There are three cargo compartment doors installed on the right side of the fuselage. The forward and the aft cargo doors are also aluminum alloy structures consisting of skins, edge members, corner pieces, horizontal beams and vertical frames.
The bulk cargo door is of plug type design opening inside the fuselage. The primary structure comprise skins, edge members and horizontal beams both being made from aluminum alloy.
The main landing gear doors are located in the lower part of the center fuselage.
They have:
- two main doors, hinged to the two longitudinal boxes of the keel beam,
- two hinged door,
- and two leg fairing doors.

All doors are of composite construction, including carbon fiber skins.
The nose landing gear doors have two forward doors, two aft doors and one fixed door. The fixed door is made of aluminum alloy, the other doors are made of sandwich type CFRP composite



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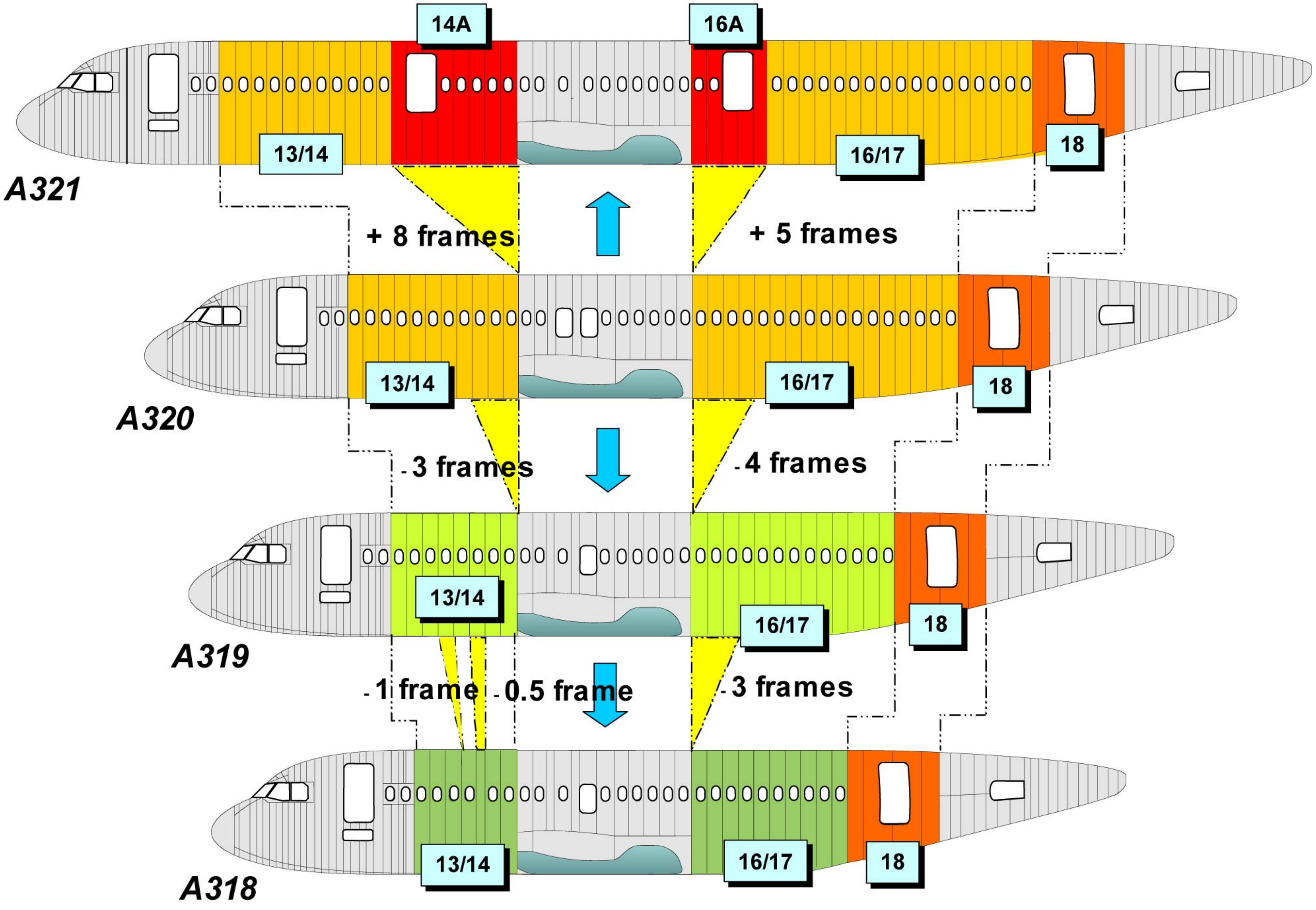
DOORS

51 STRUCTURE PRESENTATION (1)

FUSELAGE

Within the technical documentation the fuselage is divided into five main parts which are also divided into sections mainly for production purpose:
- the nose forward fuselage covered by chapter 53-10-00 and containing sections 11 and 12,
- the forward fuselage covered by chapter 53-20-00 and containing the sections 13, or 13/14, depending on A/C model,
- the center fuselage covered by chapter 53-30-00 which is also the section 15/21,
- the rear fuselage covered by chapter 53-40-00 and containing the sections 16, 17 and 18,
- the rear/cone fuselage covered by chapter 53-50-00 and containing the sections 19 and the tail cone, section 19.1.

The A321, A320, A319 and A318 have the same fuselage sections. The A321 is a stretched version of the A320 with 8 frames added FWD of the center section and 5 frames added AFT of the center section.
The A319 is a shortened version of the A320 with 3 frames removed FWD of the center section and 4 frames removed AFT the of the center section.
The A318 is a shortened version of the A319 with 1.5 frames removed FWD of the center section and 3 frames removed AFT of the center section.

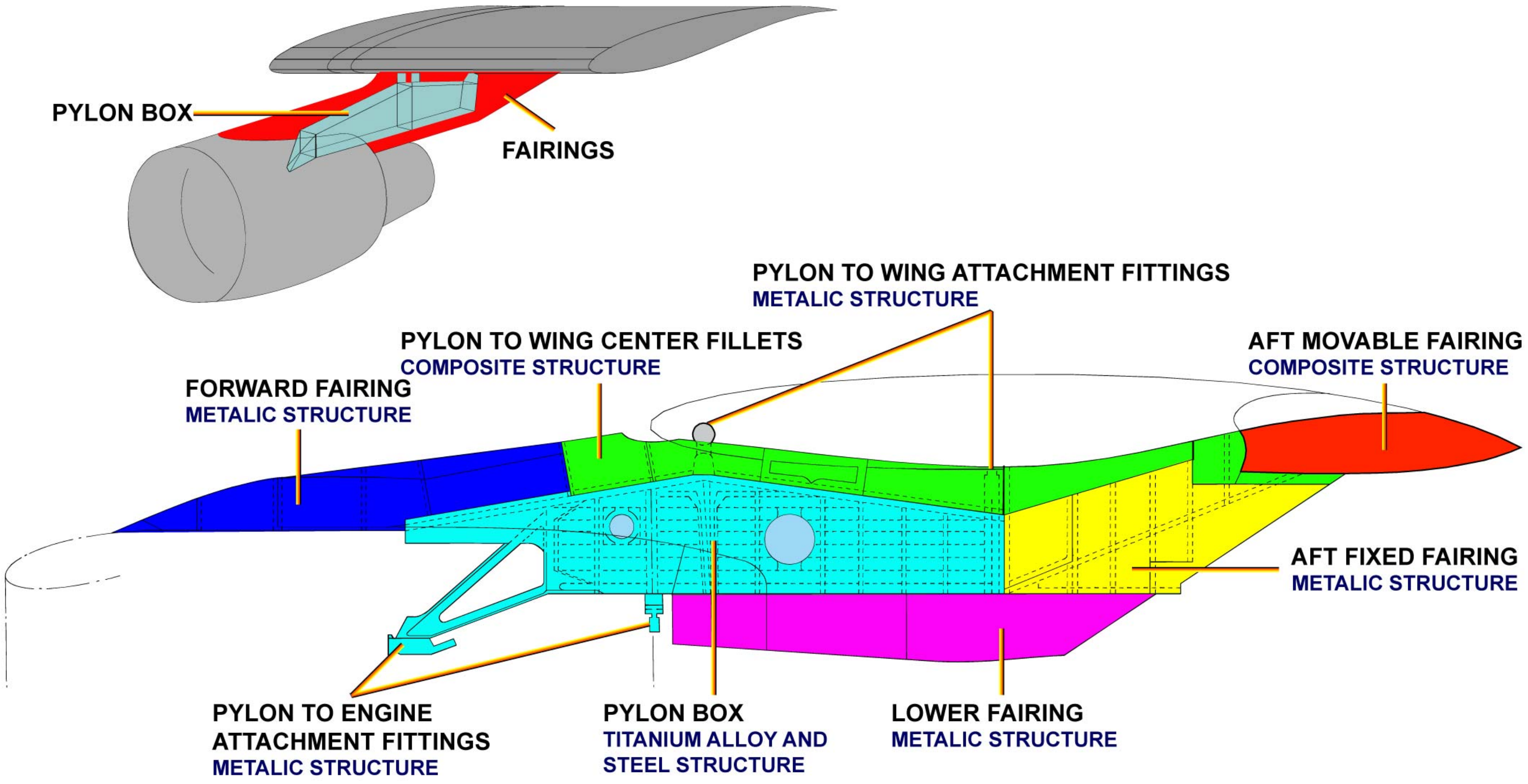

14A
16A
13/14
16/17
18
A321
+ 8 frames
+ 5 frames
13/14
16/17
18
A320
- 3 frames
- 4 frames
13/14
16/17
18
A319
- 1 frame
- 0.5 frame
- 3 frames
13/14
16/17
18
A318

FUSELAGE

51 STRUCTURE PRESENTATION (1)

PYLONS

The pylon box is the primary structure of the pylon. The secondary structure comprises the forward, the lower and the aft fairings and the pylon to wing center fillets.
The pylon box is an assembly of titanium alloy and steel parts which includes spars, ribs, side panels, engine attachment, pylon to wing attachment fittings.


PYLON BOX
FAIRINGS
PYLON TO WING ATTACHMENT FITTINGS
METALIC STRUCTURE
PYLON TO WING CENTER FILLETS
COMPOSITE STRUCTURE
AFT MOVABLE FAIRING
COMPOSITE STRUCTURE
FORWARD FAIRING
METALIC STRUCTURE
AFT FIXED FAIRING
METALIC STRUCTURE
PYLON TO ENGINE
ATTACHMENT FITTINGS
METALIC STRUCTURE
PYLON BOX
TITANIUM ALLOY AND
STEEL STRUCTURE
LOWER FAIRING
METALIC STRUCTURE

PYLONS

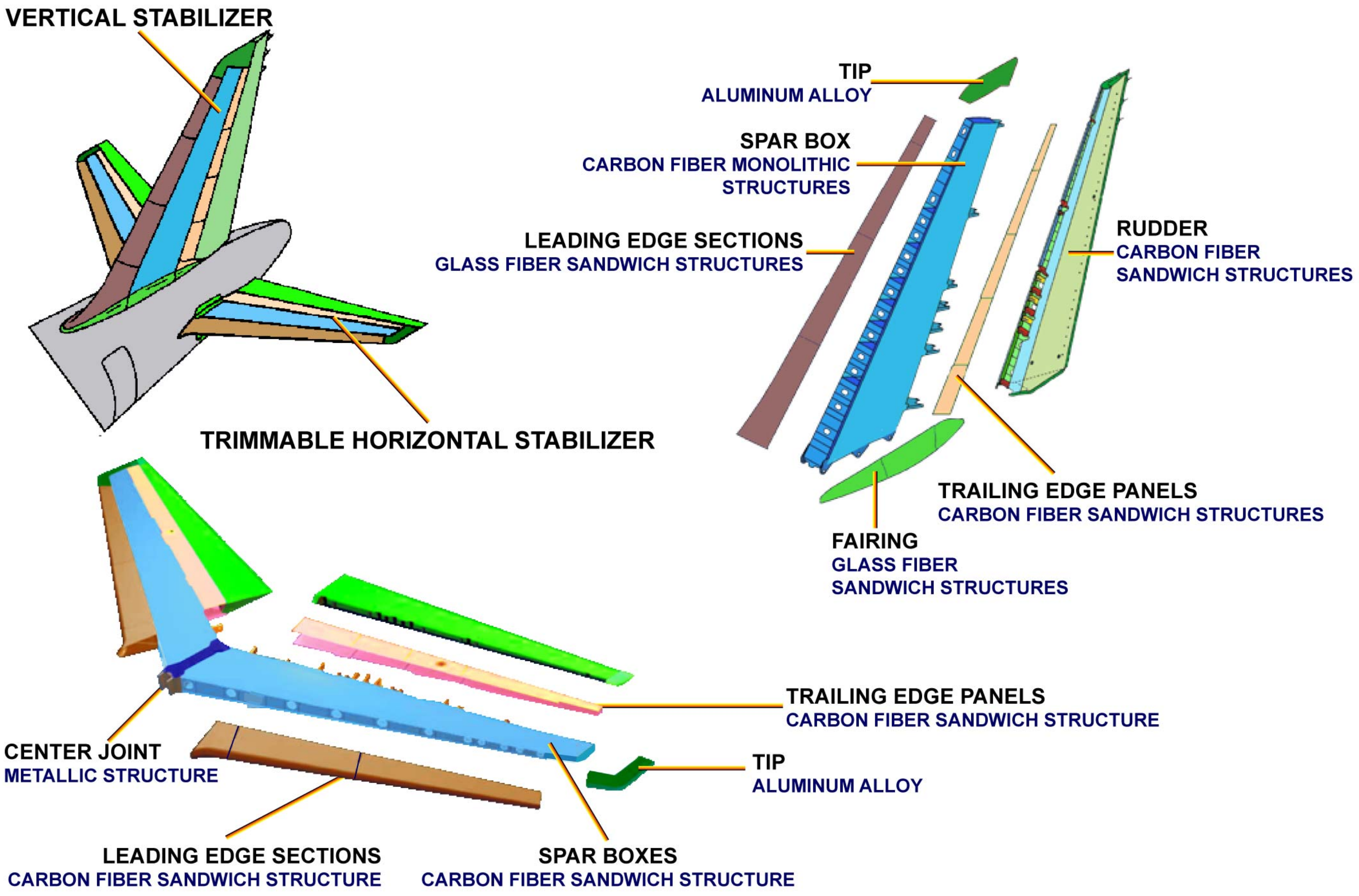
51 STRUCTURE PRESENTATION (1)

STABILIZERS - HORIZONTAL STABILIZER & ELEVATORS

The horizontal stabilizer main structure includes center joint and two outer spar boxes.
On each side, the horizontal stabilizer also includes a leading edge, a trailing edge structure, both being mainly made from Carbon Fiber Reinforced Plastic (CFRP) and a tip which is made of aluminum alloy.
The elevators are basically CFRP structure including top and bottom skin panels, ribs and front spar. The hinge and actuator fittings and the trailing edge profile are from aluminum alloy.
The vertical stabilizer structure has:
- the main spar box,
- the leading edge,
- the tip,
- and the trailing edge.

The main box is an assembly of CFRP ribs, spars and side panels.
The vertical stabilizer structure has also:
- a leading edge made of Glass Fiber Reinforced Plastic (GFRP),
- a tip made from aluminum alloy,
- a trailing edge structure made of aluminum alloy,
- and trailing edge panels made of CFRP.

The rudder structure has:
- two side panels made of CFRP,
- a front spar made of CFRP,
- leading edge panels made of CFRP,
- hinge and actuator fittings made of aluminum alloy,
- and the trailing edge profile made of aluminum alloy.



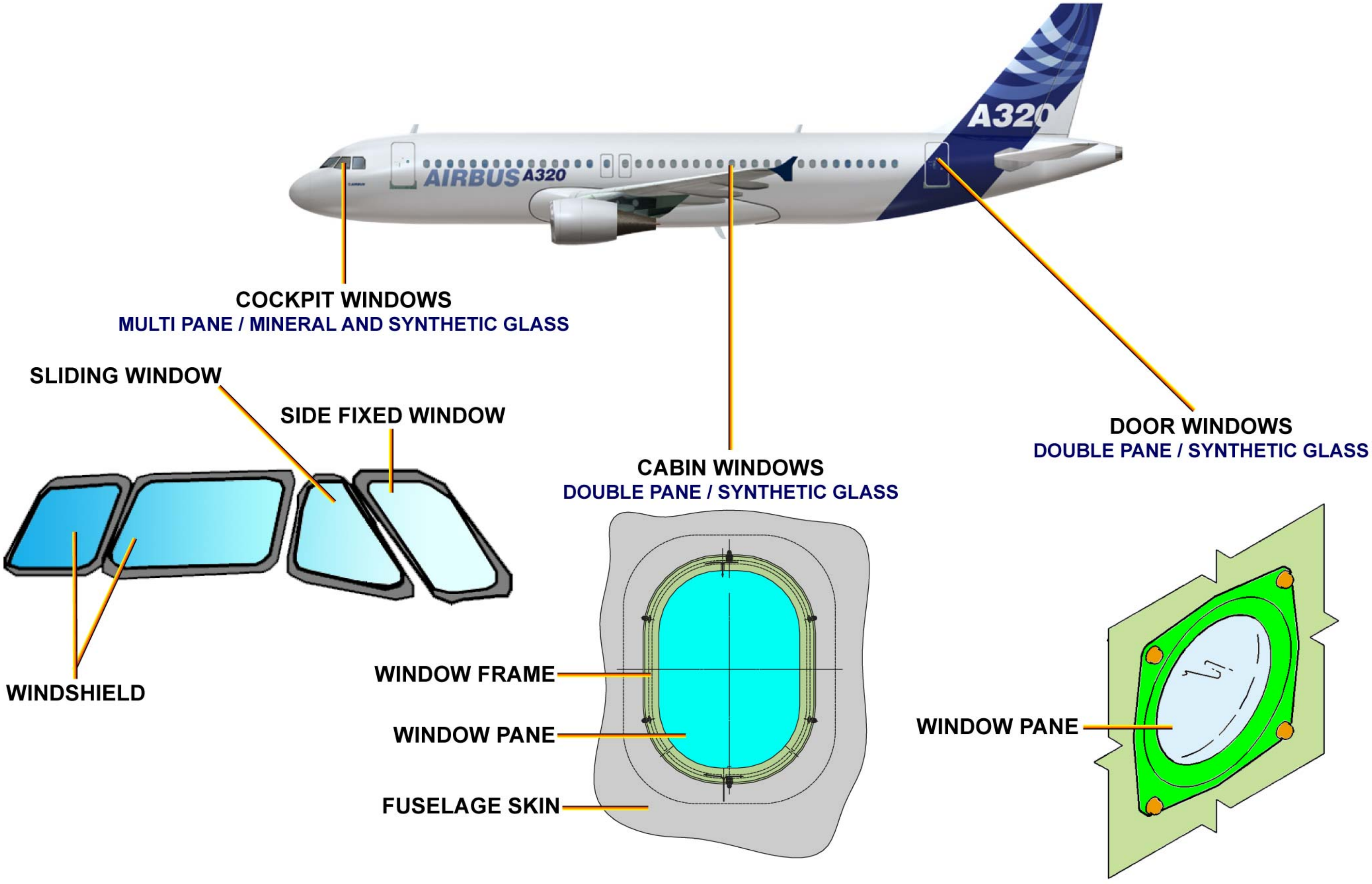
STABILIZERS - HORIZONTAL STABILIZER & ELEVATORS

U7Z08431 - U0OT4T0 - UM51PZ000000001

51 STRUCTURE PRESENTATION (1)

WINDOWS

The ATA 56 chapter describes the cockpit, cabin and door windows.
The cockpit windows include the windshield, the sliding windows and the side fixed windows.
The cabin windows include an inner and an outer pane installed in a seal. This assembly is installed in the window frame from inside the fuselage and held in position by a retainer ring
The door windows are of the same design principle as for the cabin windows.

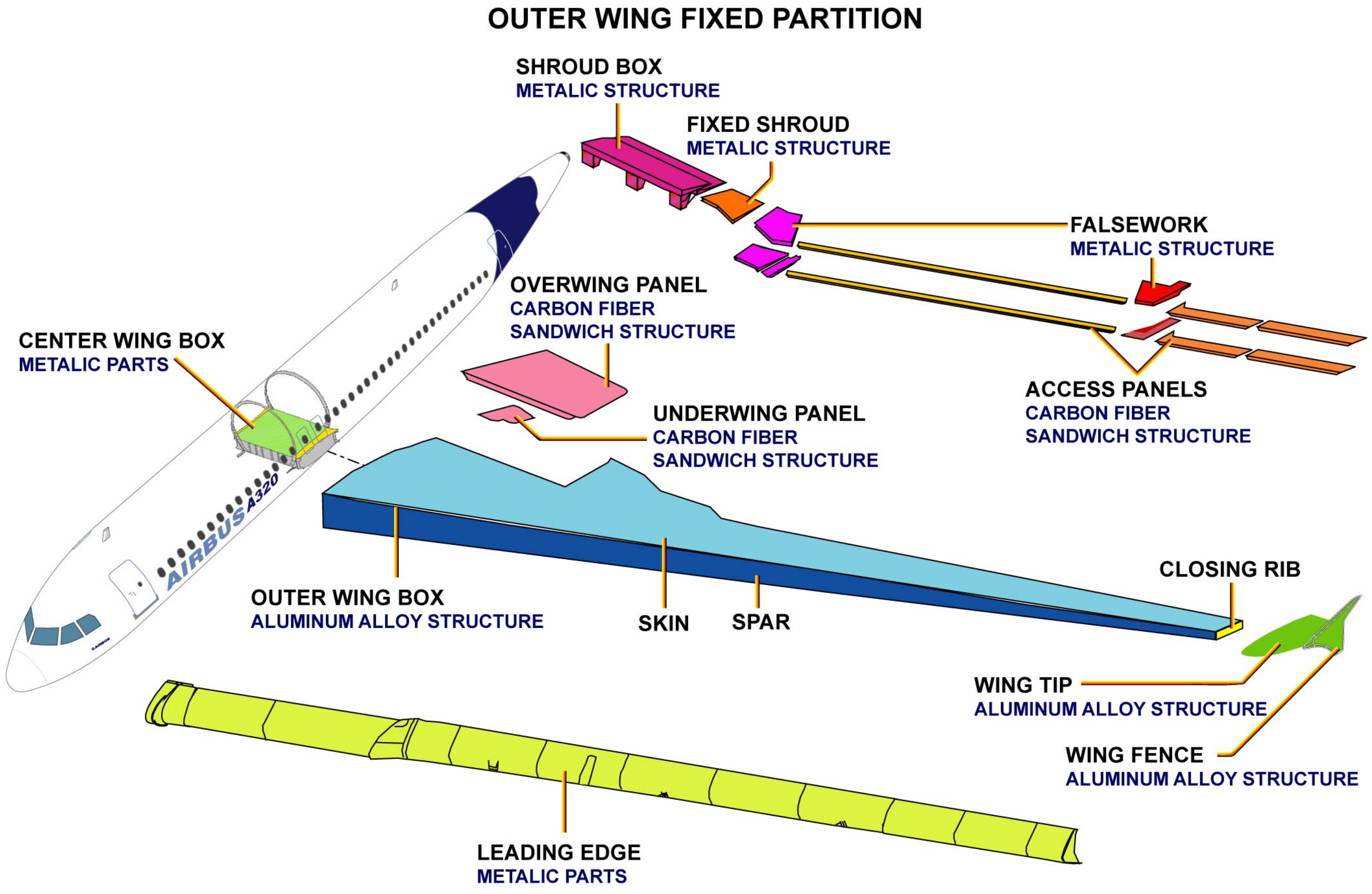

A320
AIRBUS A320
COCKPIT WINDOWS
MULTI PANE / MINERAL AND SYNTHETIC GLASS
SLIDING WINDOW
SIDE FIXED WINDOW
WINDSHIELD
CABIN WINDOWS
DOUBLE PANE / SYNTHETIC GLASS
WINDOW FRAME
WINDOW PANE
FUSELAGE SKIN
DOOR WINDOWS
DOUBLE PANE / SYNTHETIC GLASS
WINDOW PANE

WINDOWS

51 STRUCTURE PRESENTATION (1)

WINGS FIXED PARTITION

The wings consist in a center wing box which is installed in the center fuselage section and which provides the cantilever attachment of the outer wings. The center wing box is an assembly of aluminum alloy parts, located between frames 36 and 42. Each outer wing has a main box (outer wing box), which is the main load carrying structure. The main box supports a fixed leading edge structure, a fixed trailing edge structure and a wing tip.
The fixed leading edge structure has leading edge ribs, attached to the main box front spar, and which support the "D-nose" structure.
The fixed trailing edge structure includes hinge fittings and actuator fittings for the movable surfaces, and intermediate ribs. The access panels are made of CFRP.



WINGS FIXED PARTITION

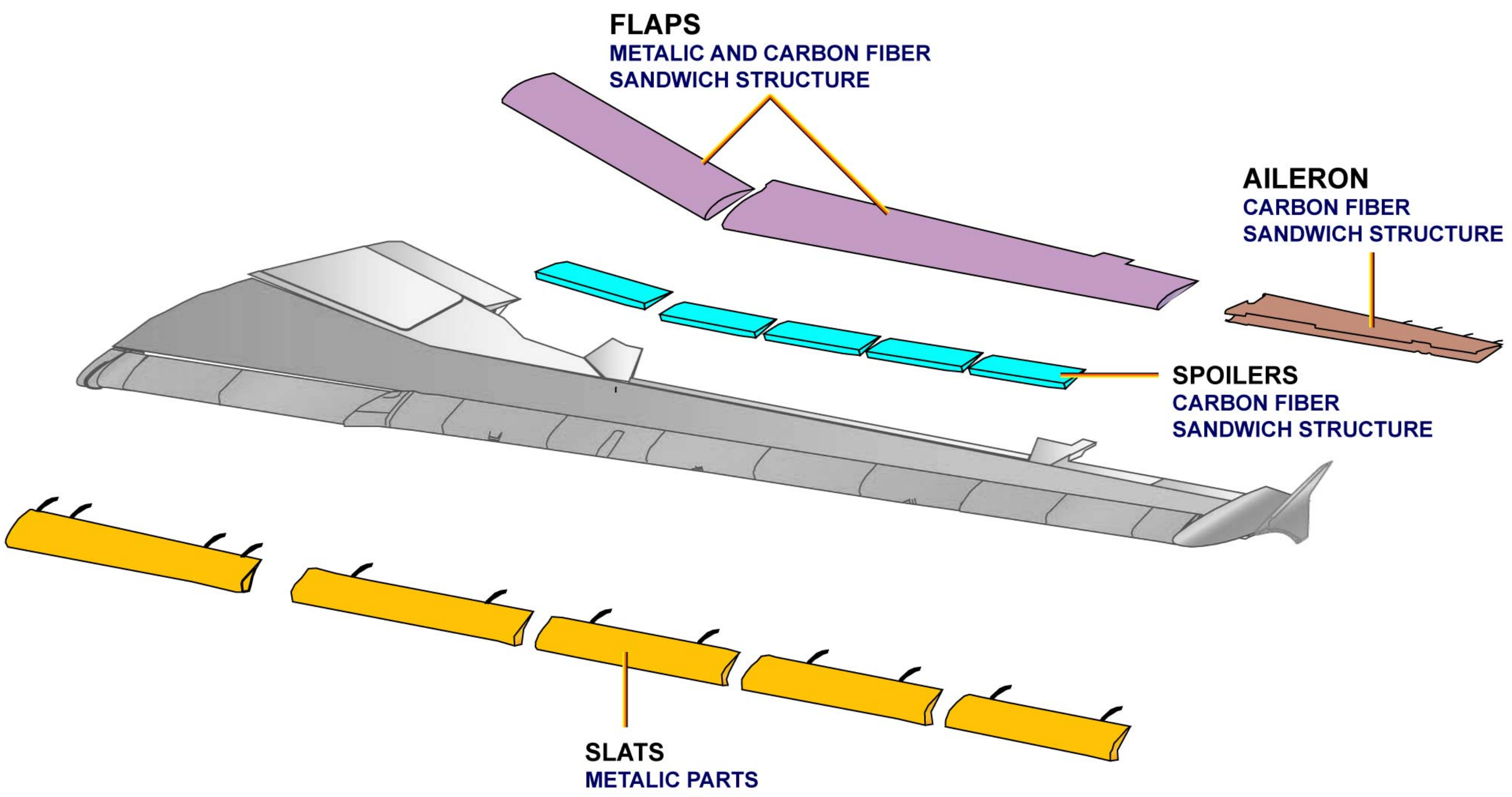
U7Z08431 - U0OT4T0 - UM51PZ000000001

51 STRUCTURE PRESENTATION (1)

WINGS MOVABLE SURFACE

Each outer wing is fitted with:
- five slats made of aluminum alloy,
- an inboard flap and an outboard flap with a CFRP structure and a sandwich aluminum trailing edge structure,
- five CFRP spoilers,
- and one aileron, mainly made from CFRP.

OUTER WING MOVABLE SURFACES



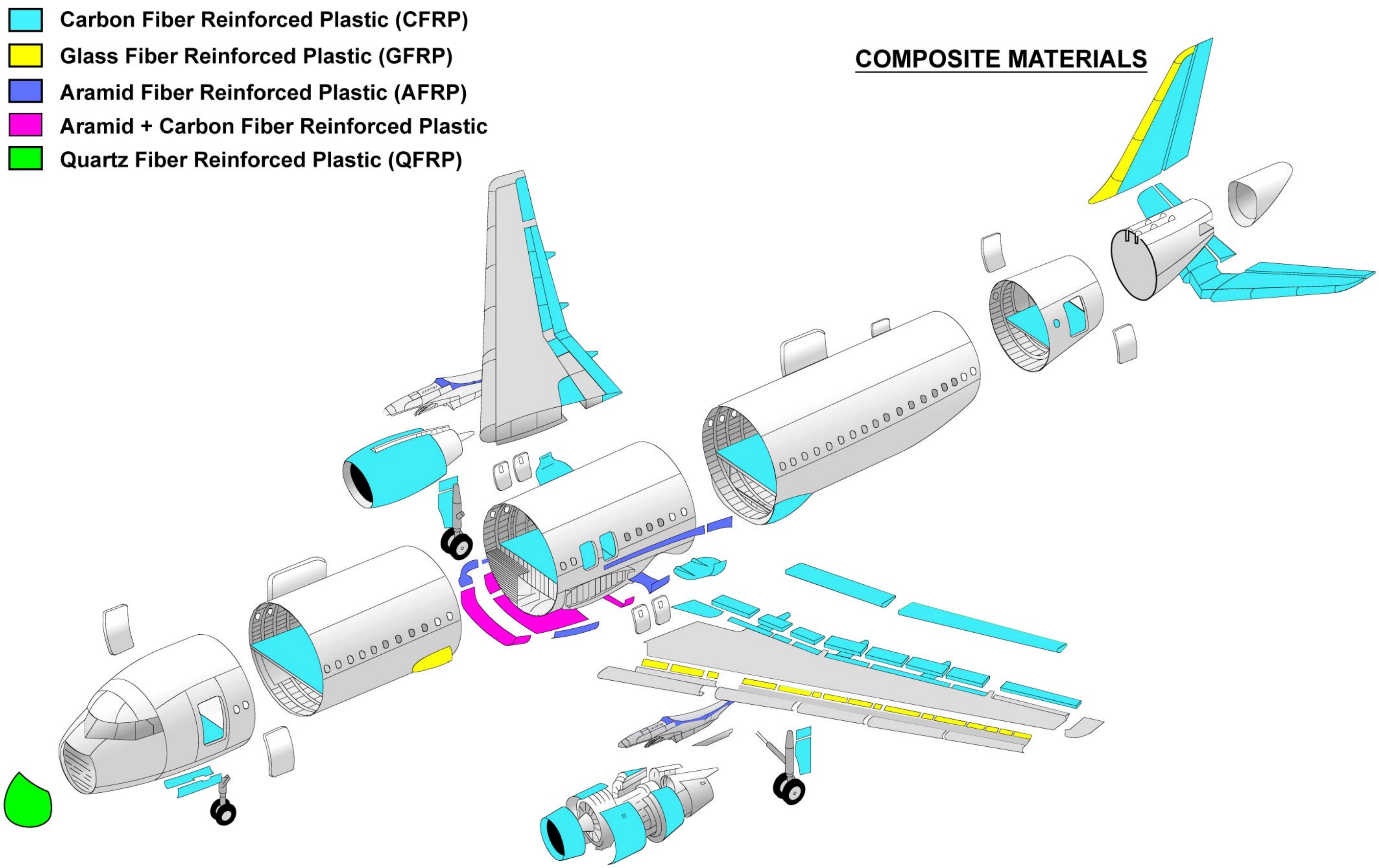
WINGS MOVABLE SURFACE

U7Z08431 - U0OT4T0 - UM51PZ000000001

51 STRUCTURE PRESENTATION (1)

COMPOSITE APPLICATIONS

The illustration shows the main application of composite materials on A320 (same materials for other aircrafts).



COMPOSITE APPLICATIONS

U7Z08431 - U0OT4T0 - UM51PZ000000001

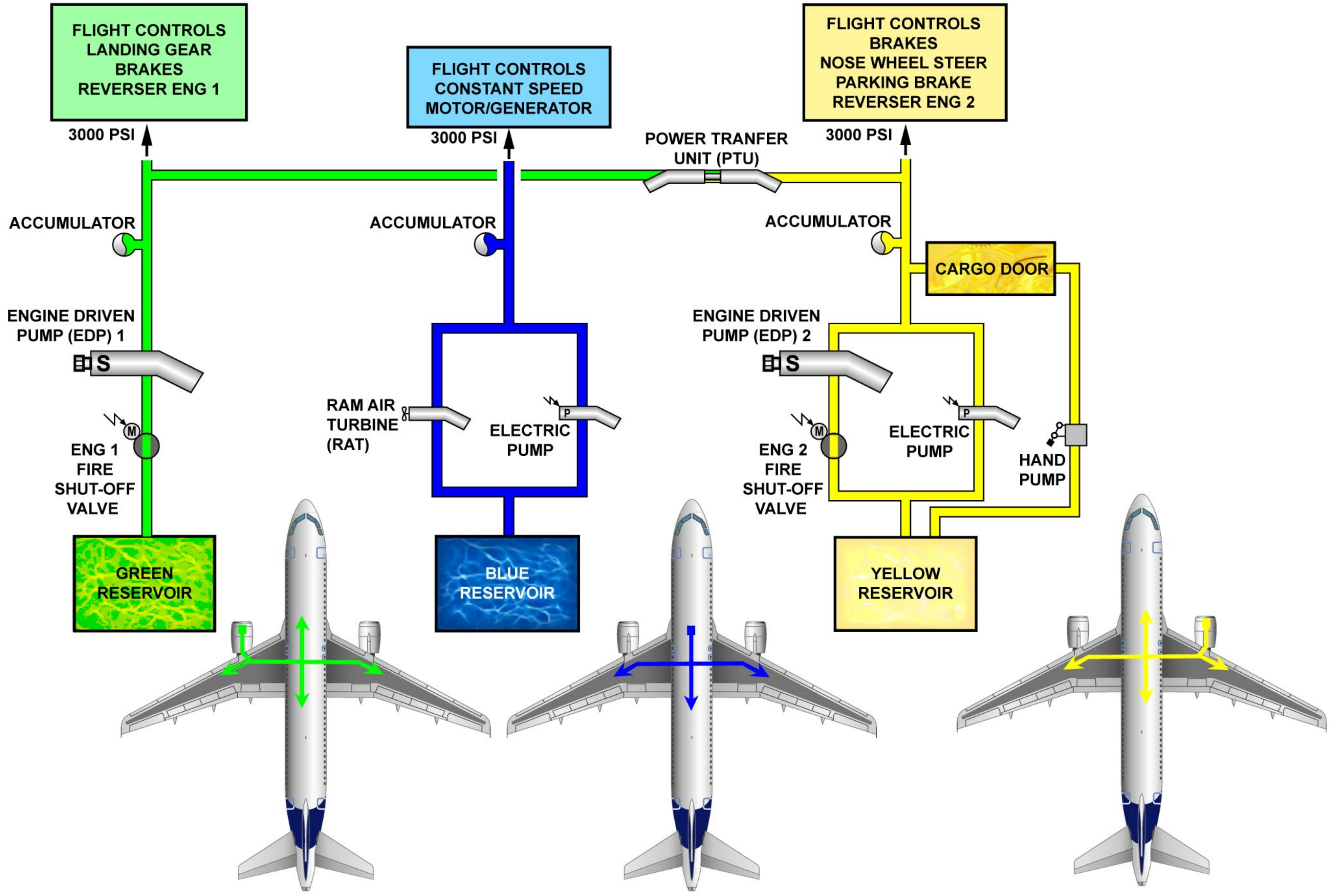
29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

SYSTEM INTRODUCTION

The aircraft has three independent hydraulic systems:
- green,
- yellow,
- blue.

The three hydraulic systems supply hydraulic power at 3000 psi to the users:
- flight controls,
- landing gear,
- brakes,
- nose wheel steering,
- cargo doors,
- thrust reverser operation,
- Constant Speed Motor / Generator (CSM/G).

Hydraulic fluid cannot be transferred from one system to another.
A reservoir in each hydraulic system is pressurized with air to prevent cavitation.
The green and yellow hydraulic systems are each pressurized by an Engine Driven Pump (EDP) 1 and 2.
The yellow hydraulic system can also be pressurized by an electric pump.
It is mainly used on ground for maintenance and cargo door operation.
If no electric power is available, a hand pump in the yellow system can be used to operate the cargo doors.
A Power Transfer Unit (PTU) enables the green system to be pressurized by the yellow system and vice versa. It transfers the hydraulic power but does not transfer the hydraulic fluid.
Fire shut-off valves are located between the reservoirs and the EDPs.
They isolate the systems in case of an engine fire.
The blue hydraulic system is pressurized by an electric pump.
The electric pump is the main pump for the blue system.
It starts running at first engine start or it can be manually activated on ground for maintenance purpose.
Blue and yellow pumps are interchangeable.
In an emergency, the blue system can be pressurized by the Ram Air Turbine (RAT).
The RAT is deployed automatically or manually. It pressurizes the blue hydraulic system at 2500 psi. It can be retracted on ground only, following a specific maintenance procedure.



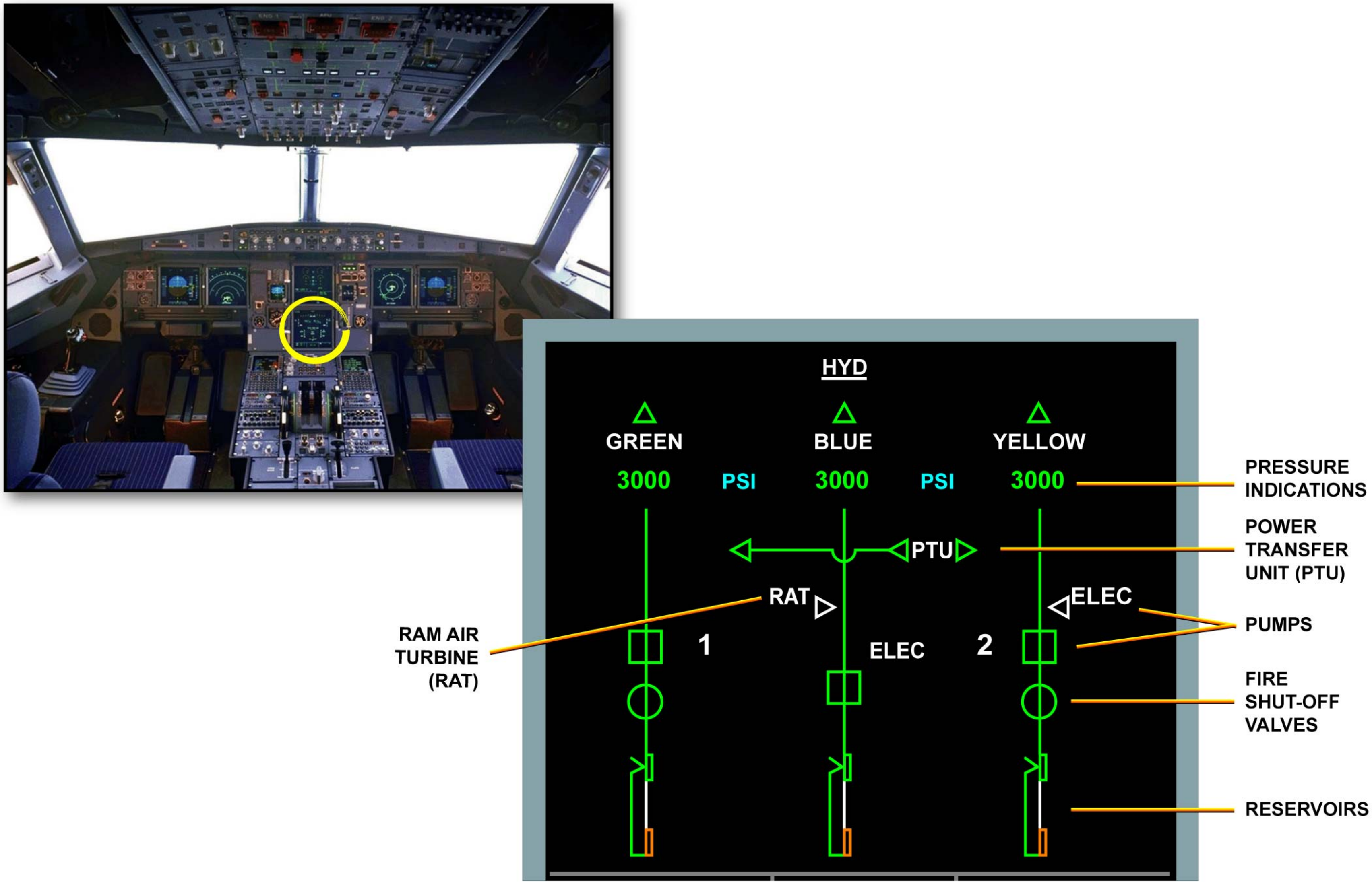
SYSTEM INTRODUCTION

29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

ECAM HYDRAULIC PAGE

The items displayed on the ECAM hydraulic page are:
- reservoirs,
- fire shut-off valves,
- pumps,
- RAT,
- PTU,
- pressure indications.

U7Z08431 - U0OT4T0 - UM29PZ000000001

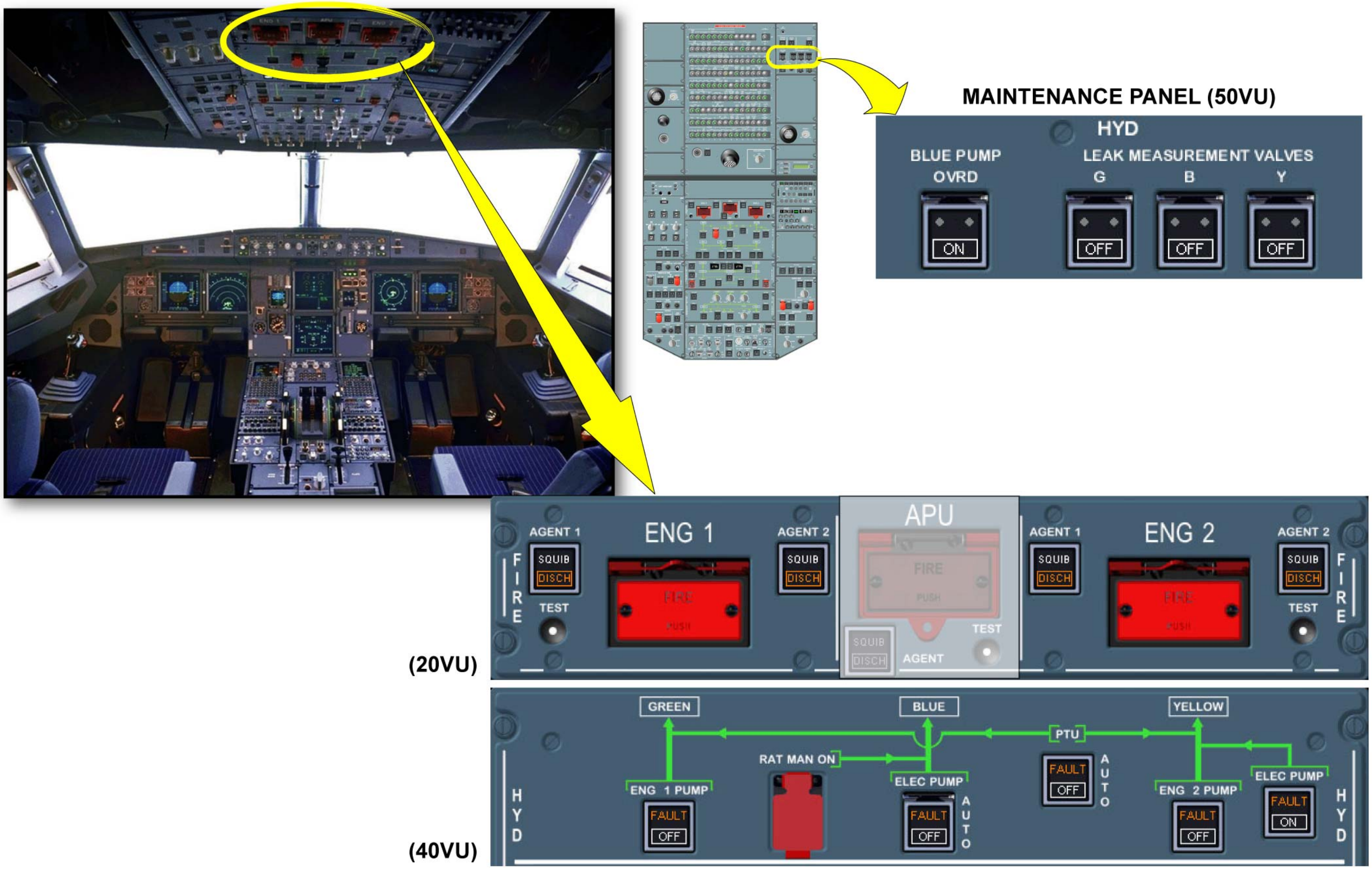


ECAM HYDRAULIC PAGE

29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

PANEL LOCATION

On the ENG FIRE panel (20VU), the fire shut-off valve pushbuttons ENG 1 (2) released out will close the fire shut-off valves.
The EDPs, electric pumps, PTU and the RAT are operated from the HYD control panel and monitored on the HYD ECAM page.
The blue electric pump can also be operated on ground for maintenance purpose by the BLUE PUMP OVRD push button on the HYD maintenance panel.
The hydraulic leak measurement system is used for maintenance purpose only.



PANEL LOCATION

U7Z08431 - U0OT4T0 - UM29PZ000000001

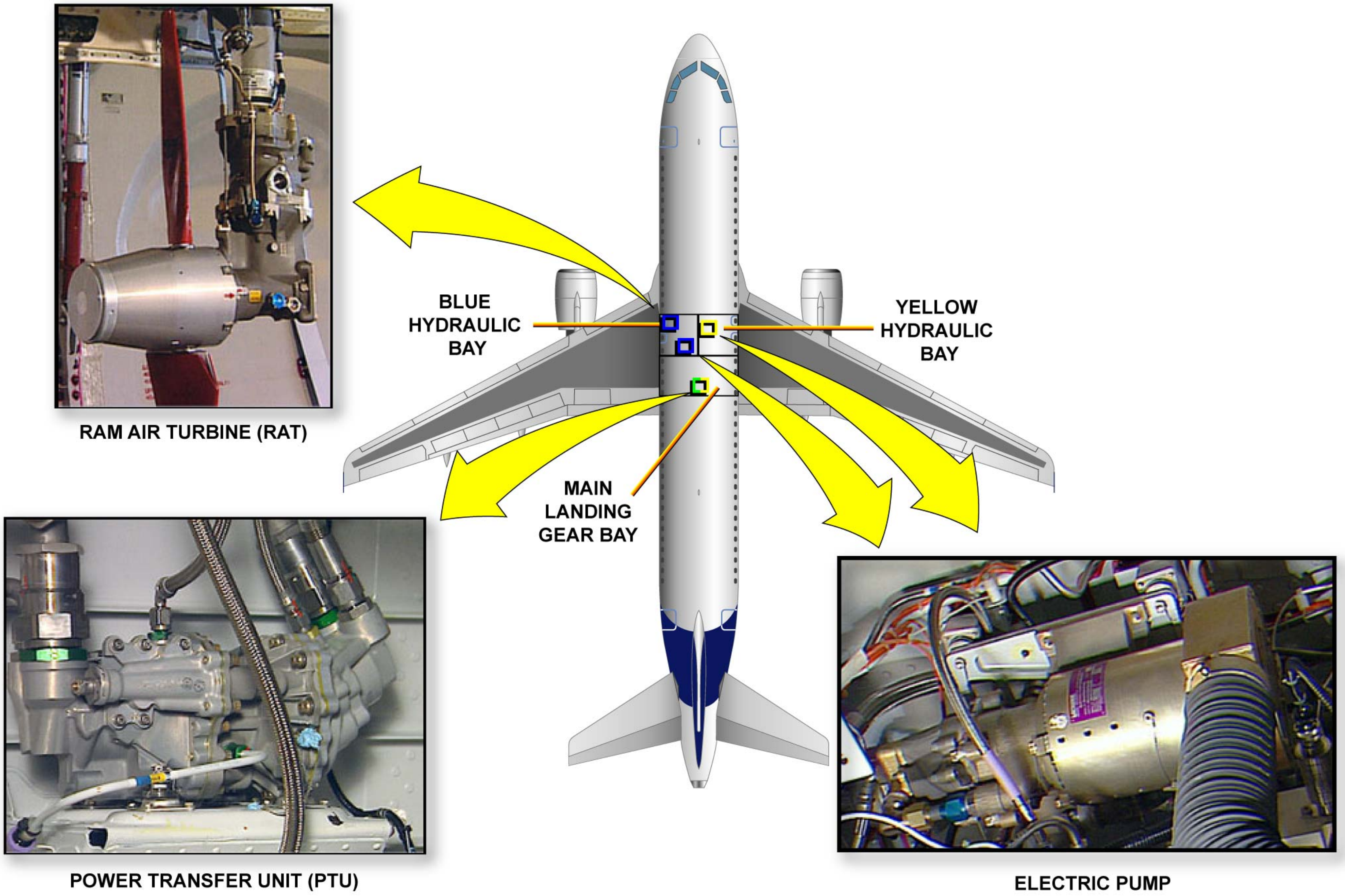
29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

COMPONENT LOCATION

PTU/ELEC PUMPS/RAT

The PTU is located in the main landing gear bay. The blue electric pump and the RAT are located in the blue hydraulic bay and the yellow electric pump is located in the yellow hydraulic bay.

U7Z08431 - U0OT4T0 - UM29PZ000000001



COMPONENT LOCATION - PTU/ELEC PUMPS/RAT

U7Z08431 - U0OT4T0 - UM29PZ000000001

29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

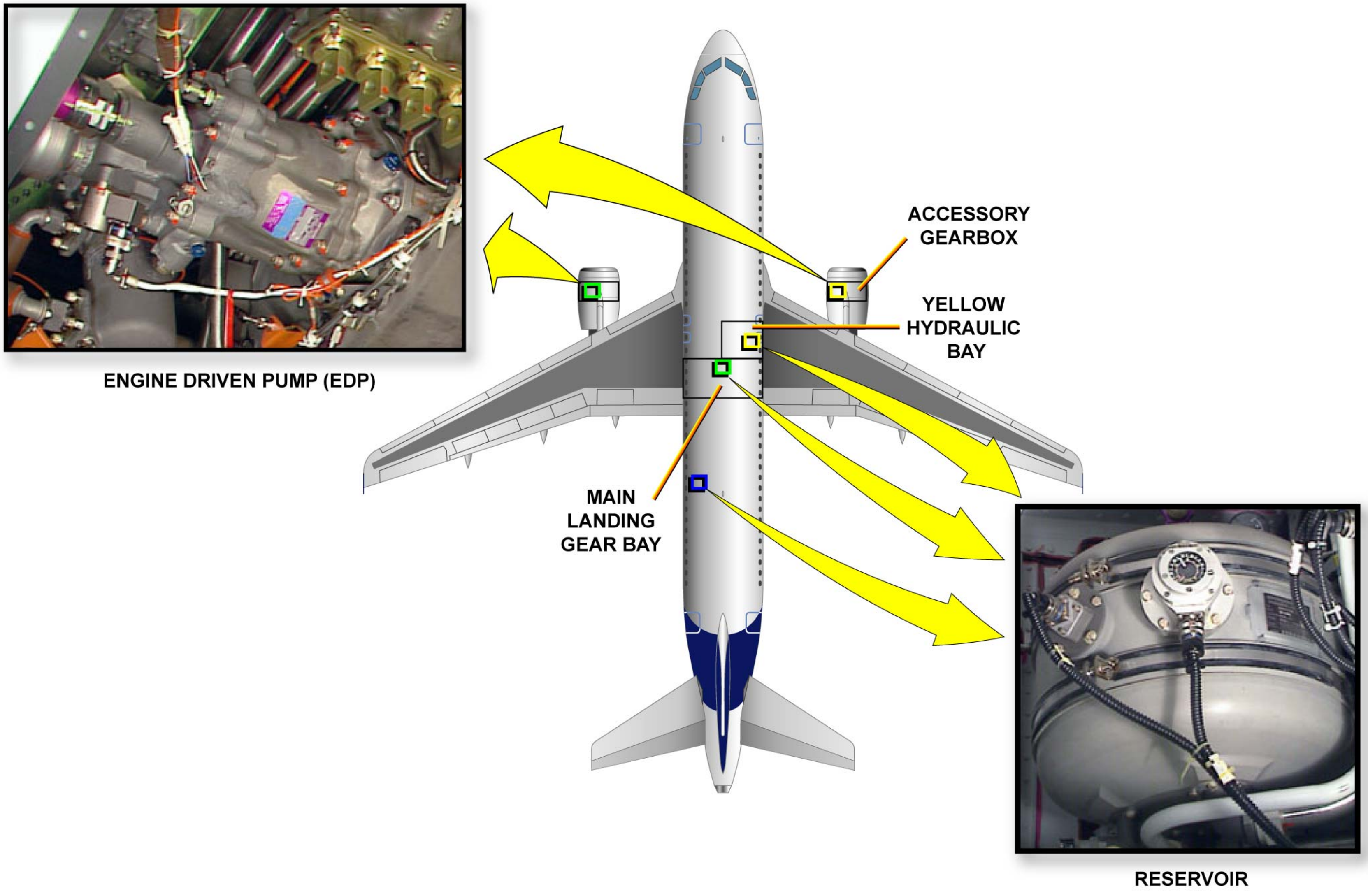
COMPONENT LOCATION (continued)

ENGINE PUMP

The EDPs 1 and 2 are located on the accessory gearbox of engine 1 (EDP 1 green system) and engine 2 (EDP 2 yellow system).

RESERVOIR

The green reservoir is located inside the main landing gear bay. The blue reservoir is located aft of the main landing gear bay on the LH side. The yellow reservoir is located inside the yellow hydraulic bay.



COMPONENT LOCATION - ENGINE PUMP & RESERVOIR

U7Z08431 - U0OT4T0 - UM29PZ000000001

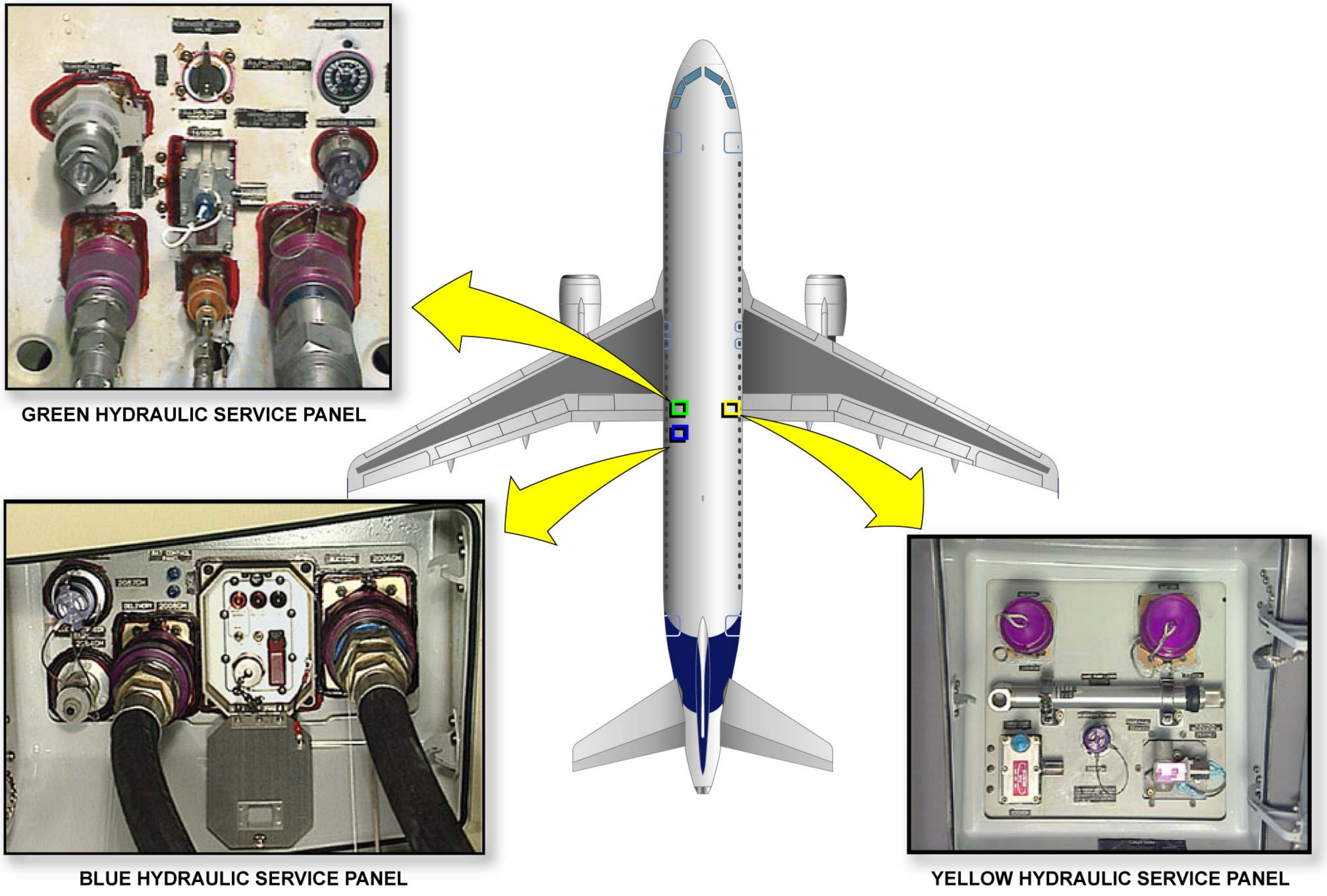
29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

COMPONENT LOCATION (continued)

SERVICING PANELS

The hydraulic servicing panels are located aft of the main landing gear bay; the green and the blue panels on the LH side, and the yellow panel on the RH side.

U7Z08431 - U0OT4T0 - UM29PZ000000001



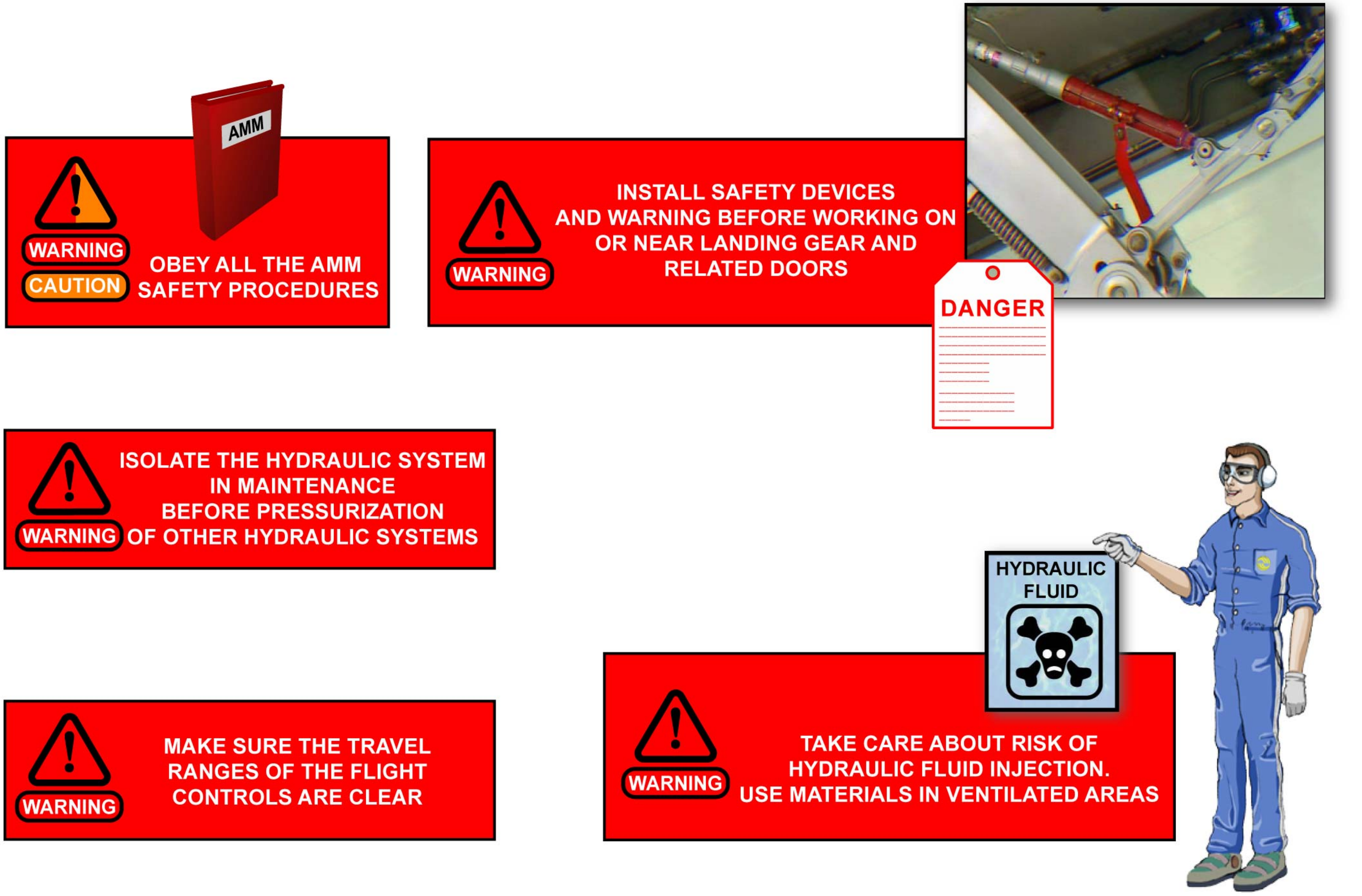
COMPONENT LOCATION - SERVICING PANELS

U7Z08431 - U0OT4T0 - UM29PZ000000001

29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on aircraft, make sure that you obey all the AMM safety procedures. This will prevent injury to persons and/or damage to the aircraft. Her is an overview of main safety precautions relative to the Hydraulic Power System.
Make sure that the hydraulic system you work on is isolated before you pressurize the other hydraulic systems.
Make sure that the travel ranges of the flight controls are clear. Movement of the flight controls can cause injury to persons and/or damage to the aircraft.
Do not get hydraulic fluid or hot gas from hydraulic reservoir on your body. Use protective clothing to prevent risk of poisoning and burns. Use solvents, cleaning agents, sealants and other special materials in a ventilated area. To prevent inadvertent breathing or contact with your body, use applicable gloves, eye protections and face mask.
Install safety devices and warning before working on or near landing gear and related doors.



SAFETY PRECAUTIONS

U7Z08431 - U0OT4T0 - UM29PZ000000001

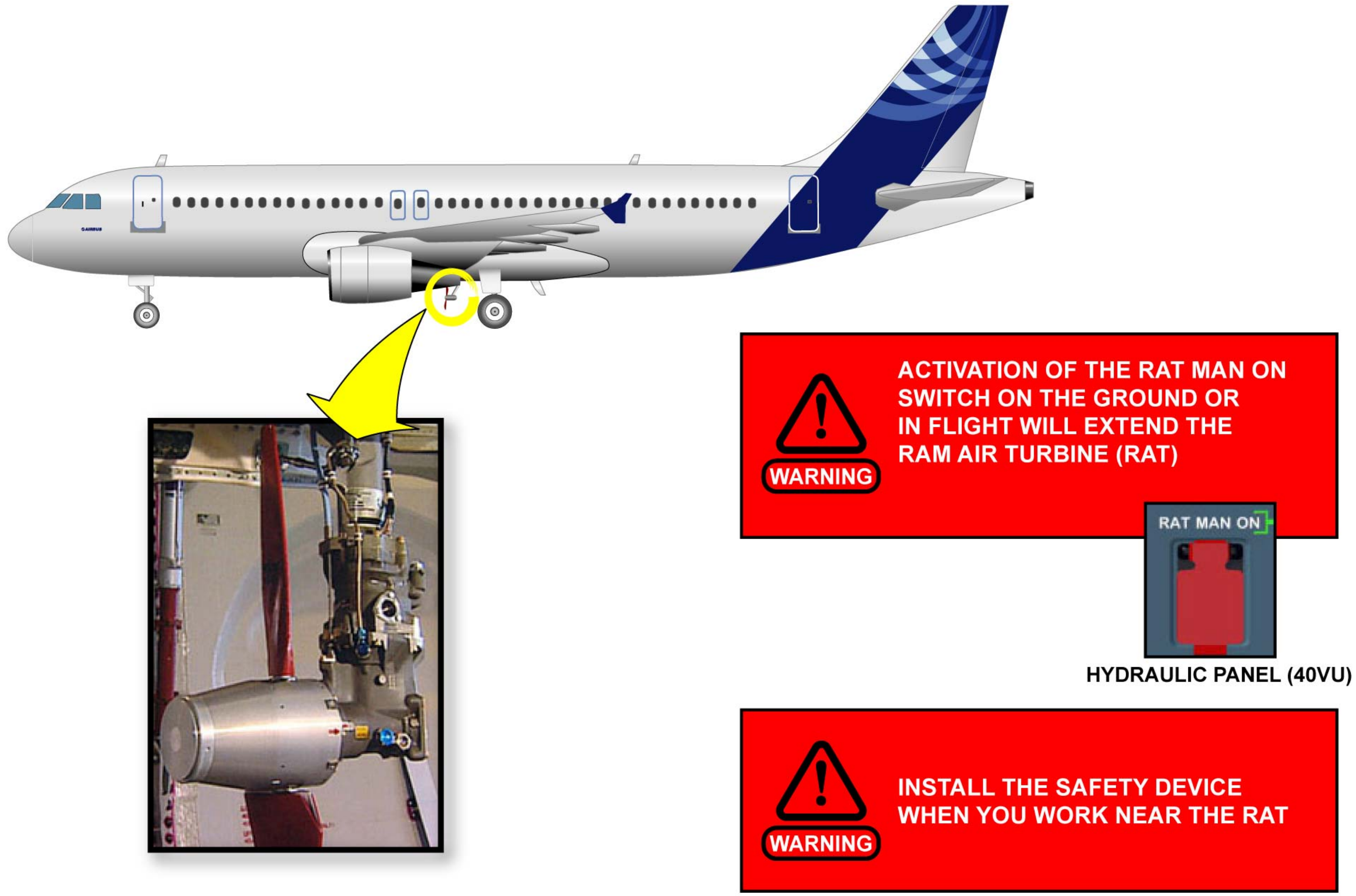
29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS (continued)

RAT

Activation of the RAT MAN ON switch on the ground or in flight will extend the RAT. Install the safety device when you work near the RAT.

U7Z08431 - U0OT4T0 - UM29PZ000000001



SAFETY PRECAUTIONS - RAT

29 HYDRAULIC POWER SYSTEM PRESENTATION (1)

ENVIRONMENTAL PRECAUTIONS

Do not discharge products such as oil, fuel, solvent, lubricant either in trash bins, soil or into the water network (drains, gutters, rain water, waste water, etc...).
Sort waste fluids and use specific waste disposal containers.
Each product must be stored in an appropriate and specific cabinet or room such as a fire-resistant and sealed cupboard.

U7Z08431 - U0OT4T0 - UM29PZ000000001

STORE PRODUCTS IN APPROPRIATE CONTAINER/CUPBOARD/ROOM

SORT WASTE FLUIDS IN CONTAINERS

AVOID FLUID SPILLAGE
USE APPROPRIATE STORAGE EQUIPMENT FOR CHEMICAL PRODUCTS

FLUID SPILL CLEANUP KIT

USE SPECIFIC WASTE DISPOS2AL CONTAINERS

ENVIRONMENTAL PRECAUTIONS

U7Z08431 - U0OT4T0 - UM29PZ000000001

32 LANDING GEAR PRESENTATION (1)

LANDING GEAR

The A320 aircraft family has a LH and RH dual wheel Main Landing Gear (MLG) and a dual wheel Nose Landing Gear (NLG).
The MLG retracts inboard into the MLG wheel well and the NLG retracts forward into the NLG wheel well. The Landing Gears (L/Gs) are hydraulically operated and electrically controlled. Each L/G has hydraulically and mechanically operated doors. Each L/G has a shock absorber.

Main Landing Gear (MLG)

Nose Landing Gear (NLG)

LANDING GEAR

U7Z08431 - U0OT4T0 - UM32PZ000000002

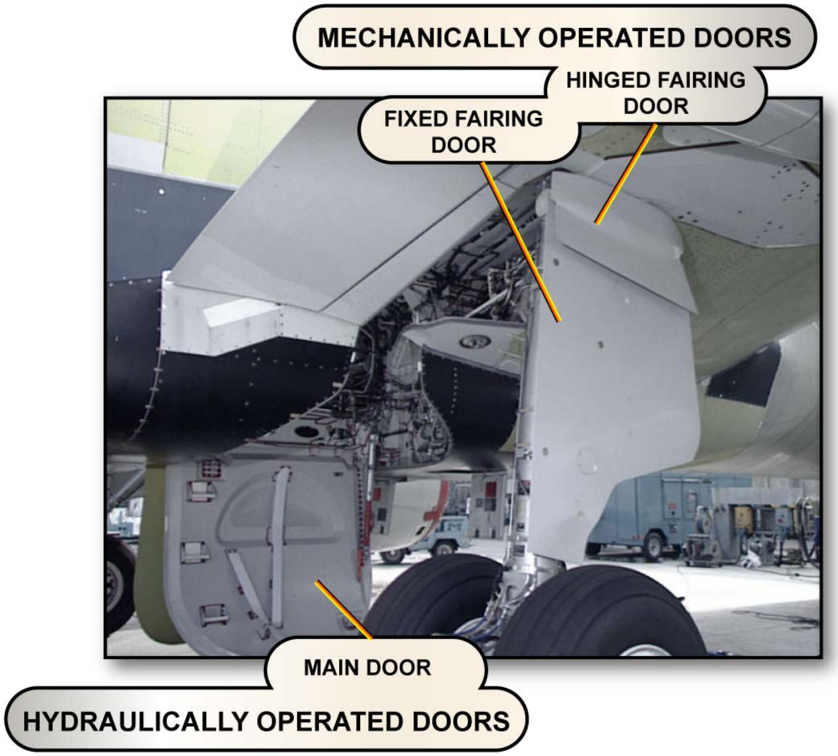
32 LANDING GEAR PRESENTATION (1)

LANDING GEAR (continued)

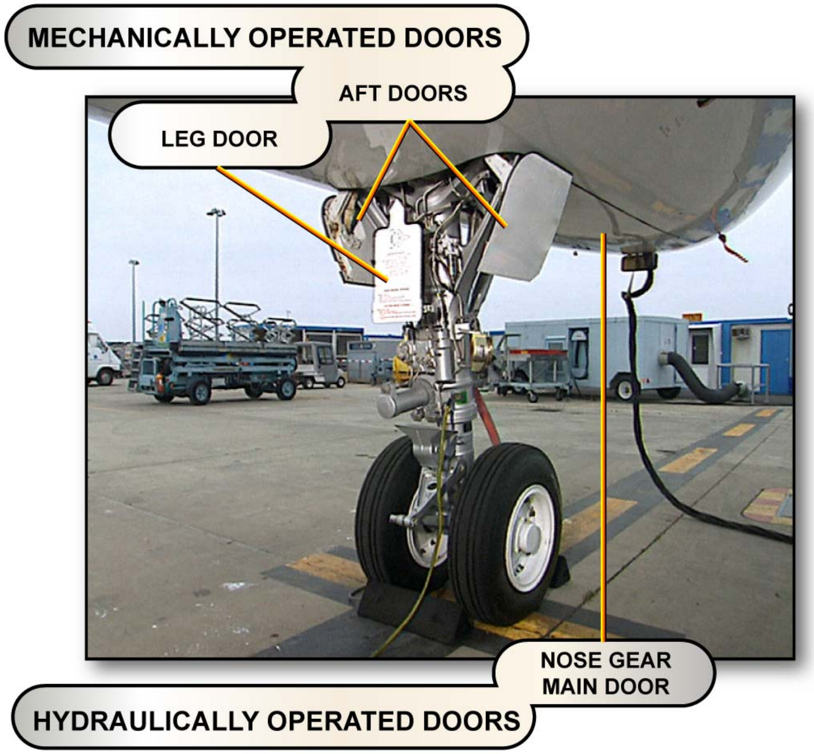
LANDING GEAR DOORS

Doors are hydraulically operated and electrically controlled.
The mechanically operated doors are linked to the L/G struts and moves with the gear.

U7Z08431 - U0OT4T0 - UM32PZ000000002



Main Landing Gear (MLG)



Nose Landing Gear (NLG)

U7Z08431 - U0OT4T0 - UM32PZ000000002

LANDING GEAR - LANDING GEAR DOORS

32 LANDING GEAR PRESENTATION (1)

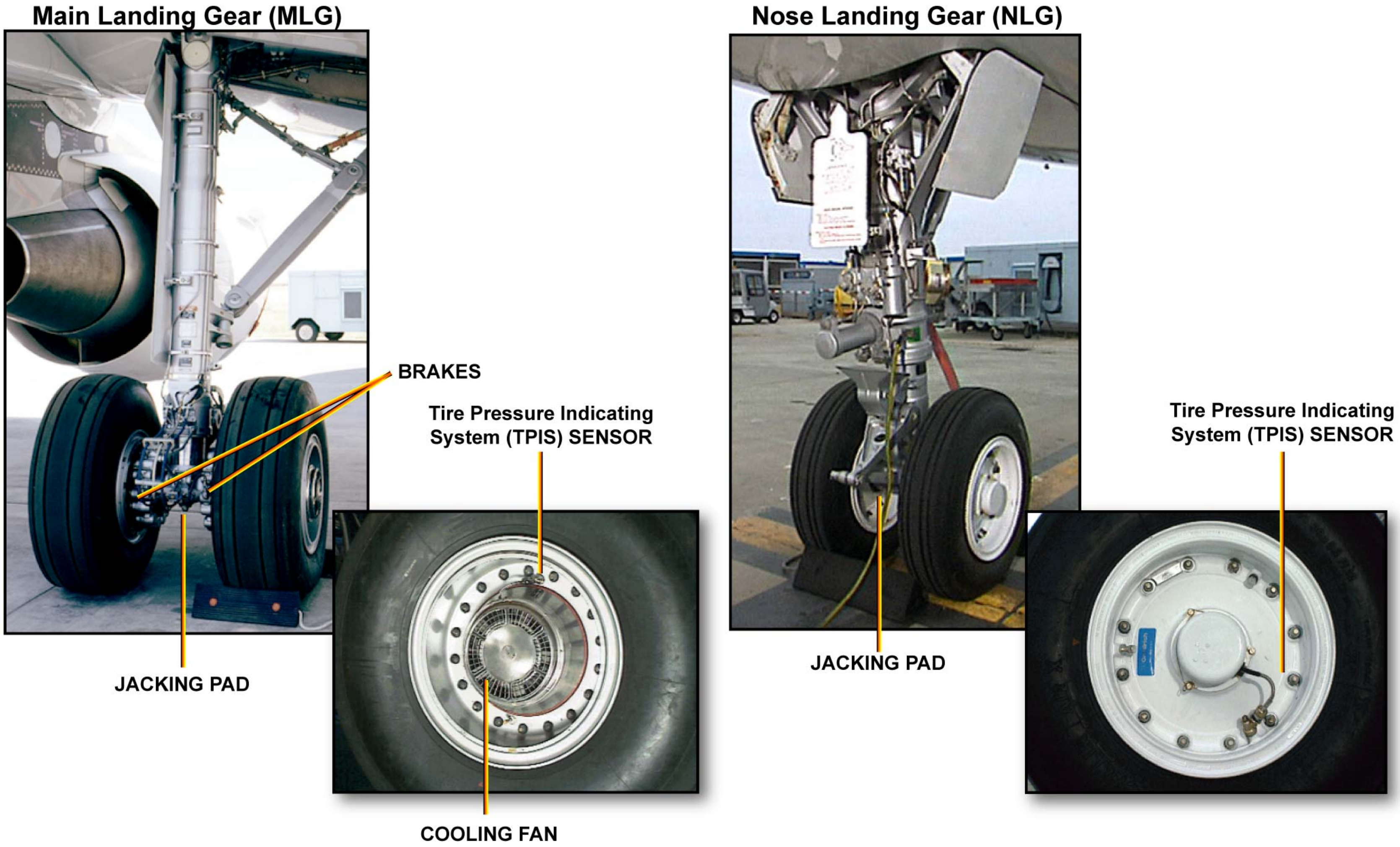
LANDING GEAR (continued)

WHEELS AND BRAKES

The MLG have:
- wheels,
- carbon brakes,
- brake fans (optional),
- Tire Pressure Indicating System (TPIS) sensor (optional),
- gear jacking pad for wheel change.

The NLG has:
- a Nose Wheel Steering (N/WS) system,
- a jacking pad for wheel change,
- a TPIS sensor (optional).

U7Z08431 - U0OT4T0 - UM32PZ000000002



LANDING GEAR - WHEELS AND BRAKES

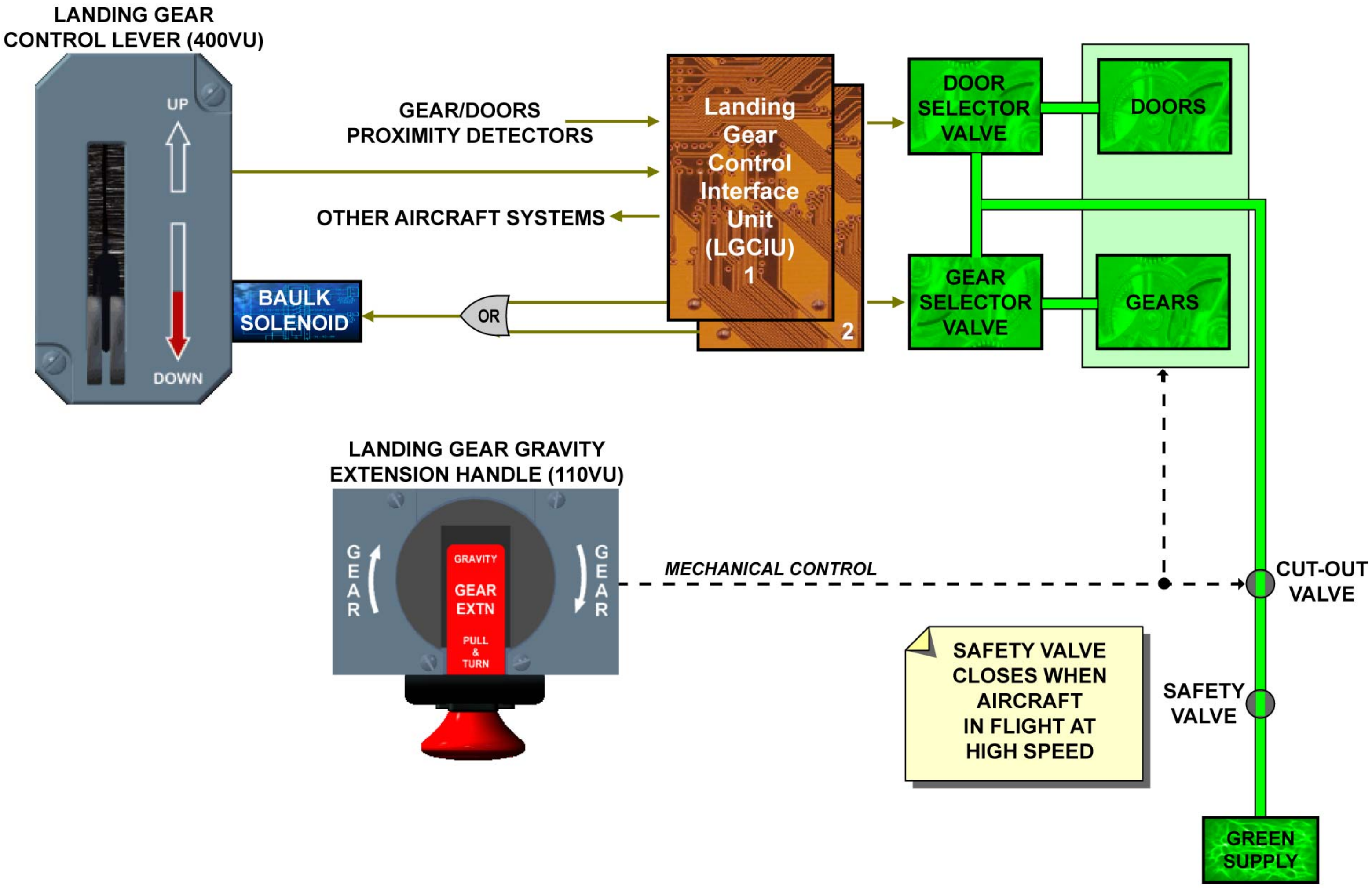
U7Z08431 - U0OT4T0 - UM32PZ000000002

32 LANDING GEAR PRESENTATION (1)

LANDING GEAR EXTENSION AND RETRACTION

The L/G extension and retraction is controlled from the L/G control lever located in the cockpit.
The gear up and down sequence is controlled by two computers called Landing Gear Control and Interface Unit (LGCIU) 1 and 2. Only one LGCIU is in command while the other LGCIU is in standby. With any up selection the LGCIU in command will change and control a complete gear cycle.
The gear up and down position and the door close and open position are monitored by proximity detectors.
In case of failure of a LGCIU or a proximity detector, the other LGCIU will be in command.
An interlock mechanism prevents unsafe retraction by locking the control lever in the down position when any shock absorber is not extended.
The Nose Wheel (N/W) is automatically centered when the shock absorber is extended.
The L/G is powered by the green hydraulic system. At high air speed a safety valve cuts hydraulic supply to the L/G system.
In case of failure, the gear can be extended mechanically from the cockpit by means of a free fall extension handle. During free fall extension, a cut-out valve will close to cut the L/G hydraulic supply.

U7Z08431 - U0OT4T0 - UM32PZ000000002



LANDING GEAR EXTENSION AND RETRACTION

U7Z08431 - U0OT4T0 - UM32PZ000000002

32 LANDING GEAR PRESENTATION (1)

BRAKING

There are two braking modes:
- normal braking,
- alternate braking.

The normal braking system is powered by the green hydraulic system.
The alternate brake system is powered by the yellow hydraulic system and backed up by a brake accumulator.
All braking functions are controlled by the Braking/Steering Control Unit (BSCU).
These functions are:
- normal and alternate braking,
- Anti-Skid (A/SKID) control,
- auto braking,
- brake temperature indication.

NORMAL BRAKING

In manual normal braking, electrical braking orders are sent by the brake pedals to the BSCU. The BSCU energizes the normal brake selector valve allowing green pressure to supply the brakes trough the automatic selector and normal servo valves.
Depending on manual braking orders and A/SKID regulation, the BSCU regulates the pressure delivered to each brake through the normal servo valves.
Wheel rotating speed from the tachometer, aircraft speed data and braking pressure are supplied to the BSCU for braking and A/SKID computation.
Before landing, the crew can select one of the auto brake modes MAXimum, MEDium or LOw, to obtain the optimal deceleration rate compatible with the length of the runway.
Before take-off, MAXimum mode must be selected in case of an aborted take-off.
Braking starts when the ground spoilers deploy.
Depending on the deceleration rate and the A/SKID regulation, the BSCU regulates the pressure delivered to each brake trough the normal servo valves.
When the aircraft deceleration reaches a given value, the DECELerate green light on the L/G panel comes on.
In order to stop the MLG wheels rotation before entry into the L/G bay, a programmed brake pressure is sent to the normal brakes during gear retraction.
Optionally, the N/Ws are mechanically braked at the end of the gear cycle using brake bands.
When there is no braking order, the servo valve is fully closed.

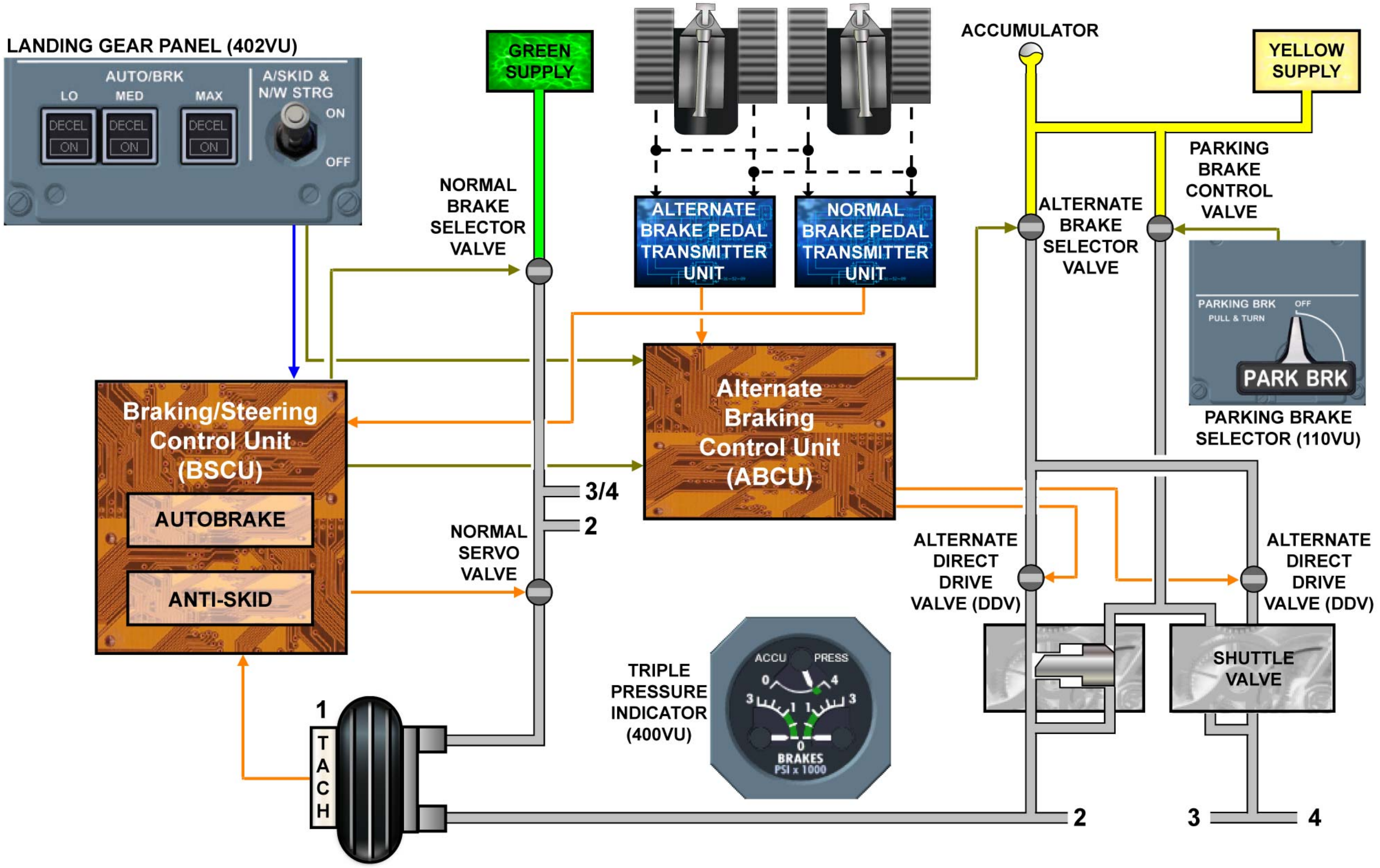
ALTERNATE BRAKING

The alternate brake system is powered by the yellow hydraulic system and backed up by a brake accumulator.
The alternate braking with A/SKID or without A/SKID is electrically controlled by the Alternate Braking Control Unit (ABCU); but the BSCU supplies the A/SKID orders to the ABCU.
The ABCU becomes active when the normal brake system is faulty and/or low hydraulic pressure in the green system. The information comes from the BSCU.
Braking inputs are given by the brake pedals and transmitted through the Alternate Brake Pedal Transmitter Unit to the ABCU which will control the braking pressure.
The braking data are sent to the BSCU for calculating the A/SKID protection.
The braking pressure is read on the triple indicator.
The A/SKID regulation is disconnected, either electrically by setting OFF the A/SKID & N/W STeeRinG switch, BSCU failure or hydraulic low pressure in the green and yellow hydraulic system (brakes being supplied by the brake accumulator only).
The pilot must refer to the triple pressure indicator to limit brake pressure in order to avoid locking a wheel. Nevertheless in that case the brake pressure is limited to max 1000PSI by the ABCU.

With the accumulator pressure only, a maximum of 7 full brake pedal applications can be done.

PARKING BRAKE

The parking brake system is supplied either by the yellow hydraulic pressure or by the brake accumulator. When the parking brake is set, the brakes are supplied by the yellow system pressure or by the brake accumulator through the shuttle valve.
Putting ON the parking brake, the other braking modes and the A/SKID system are deactivated.
With the parking brake handle in ON position, the parking brake control valve is open and the yellow pressure goes through the parking brake control valve, reaching the dual shuttle valves. The BSCU and ABCU will deactivate the other braking modes.
The pressure delivered to the LH and RH brakes as well as the brake accumulator pressure are indicated on the triple pressure indicator.



BRAKING - NORMAL BRAKING ... PARKING BRAKE

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32 LANDING GEAR PRESENTATION (1)

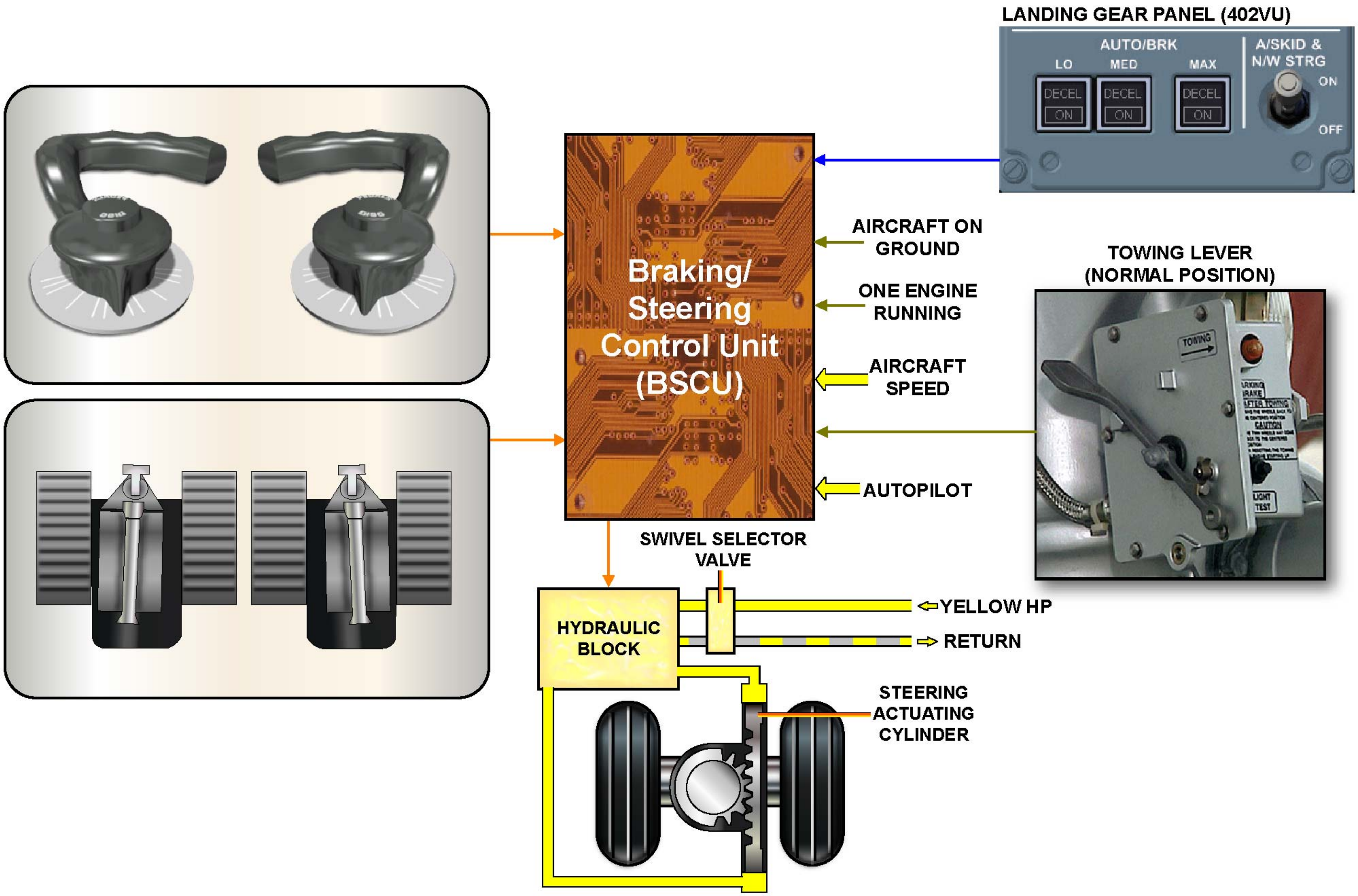
STEERING

The steering system uses the yellow hydraulic system to operate a steering actuating cylinder, which changes the direction of the NLG wheels.
The steering system is controlled by the BSCU, which receives order from:
- the steering hand wheels (orders added algebraically),
- the rudder pedals,
- the autopilot.

The BSCU transforms the orders into N/WS angle. That angle has the following limits:
- Ruder pedals: max 6 degrees,
- Hand wheels: max 74 degrees.

The steering system receives hydraulic pressure in the following conditions:
- A/SKID & N/W STeeRinG switch in ON,
- towing control lever in normal position,
- at least one ENG MASTER switch ON,
- aircraft is on ground.

U7Z08431 - U0OT4T0 - UM32PZ000000002


LANDING GEAR PANEL (402VU)
AUTO/BRK
LO
MED
MAX
DECEL
ON
DECEL
ON
DECEL
ON
A/SKID &
N/W STRG
ON
OFF
Braking/
Steering
Control Unit
(BSCU)
AIRCRAFT ON
GROUND
ONE ENGINE
RUNNING
AIRCRAFT
SPEED
AUTOPILOT
TOWING LEVER
(NORMAL POSITION)
SWIVEL SELECTOR
VALVE
HYDRAULIC
BLOCK
YELLOW HP
RETURN
STEERING
ACTUATING
CYLINDER

STEERING

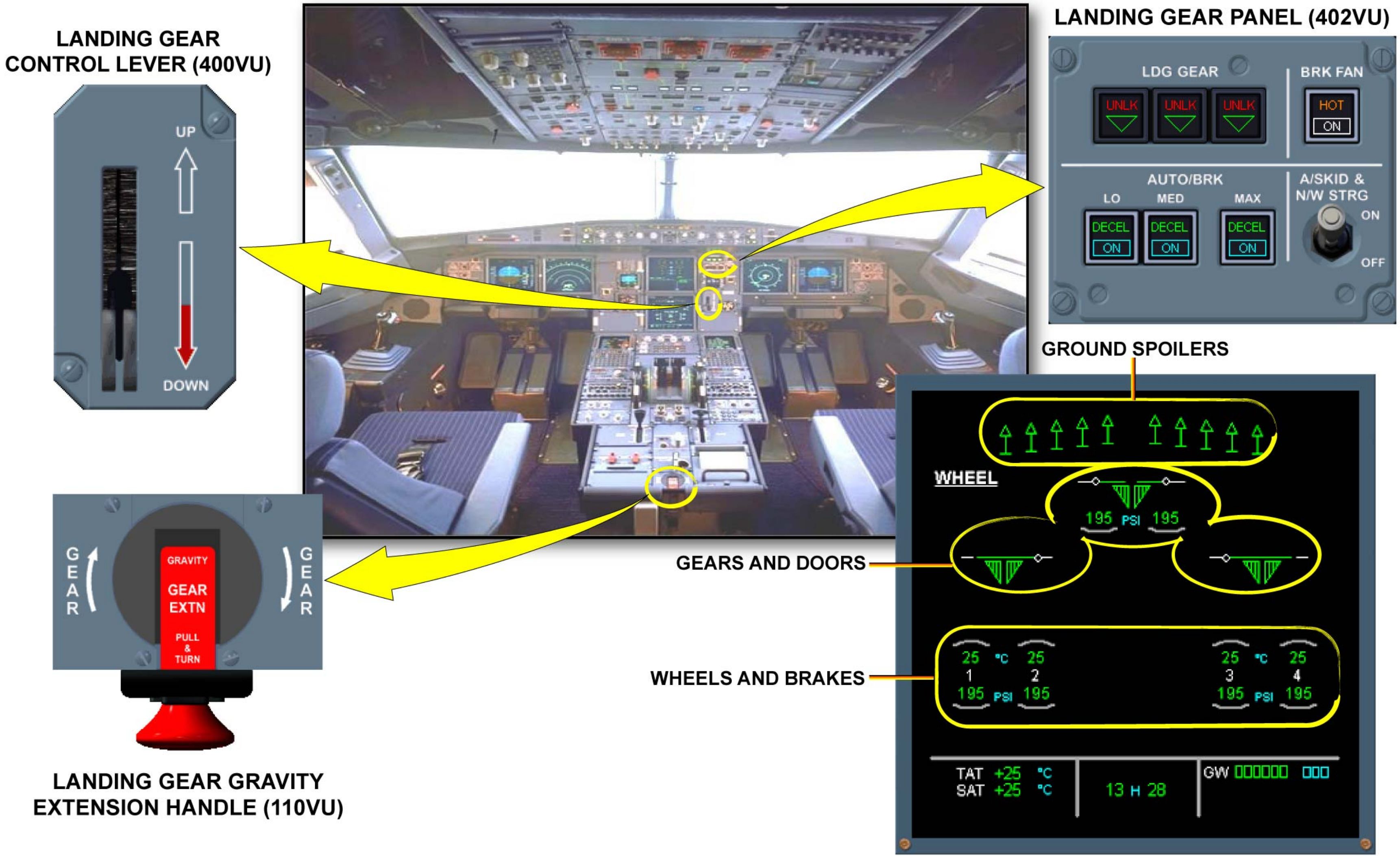
32 LANDING GEAR PRESENTATION (1)

CONTROL AND INDICATING

This section will highlight the control panels and indications for the landing gear system.

LANDING GEAR / BRAKES CONTROL AND INDICATING

Cockpit panel location:
- L/G control lever,
- L/G gravity extension handle,
- L/G panel which includes:
- L/G position indication panel,
- auto brake mode selection panel,
- brake fan indication/selection panel, and
- A/SKID & N/W STeeRinG selector.
- ECAM WHEEL page.



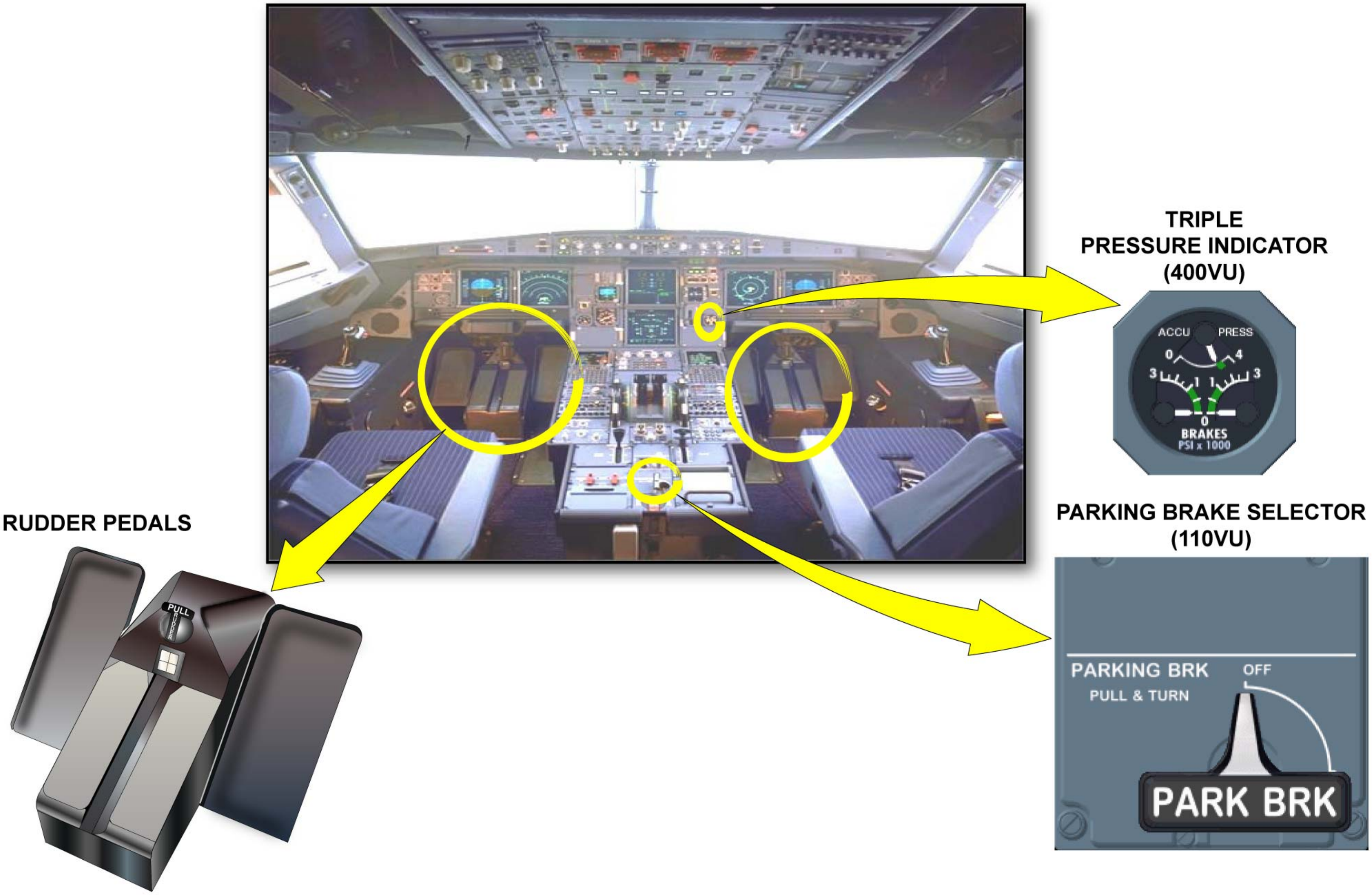
CONTROL AND INDICATING - LANDING GEAR / BRAKES CONTROL AND INDICATING

32 LANDING GEAR PRESENTATION (1)

CONTROL AND INDICATING (continued)

INDICATOR, PARKING BRAKE HANDLE, RUDDER PEDALS

Cockpit panel location:
- triple pressure indicator for brake accumulator pressure and alternate/parking brake pressure,
- parking brake selector,
- rudder/brake pedals.



CONTROL AND INDICATING - INDICATOR, PARKING BRAKE HANDLE, RUDDER PEDALS

U7Z08431 - U0OT4T0 - UM32PZ000000002

32 LANDING GEAR PRESENTATION (1)

CONTROL AND INDICATING (continued)

NOSE WHEEL STEERING

N/WS control:
- rudder/steering pedals,
- N/WS hand wheels.

U7Z08431 - U0OT4T0 - UM32PZ000000002

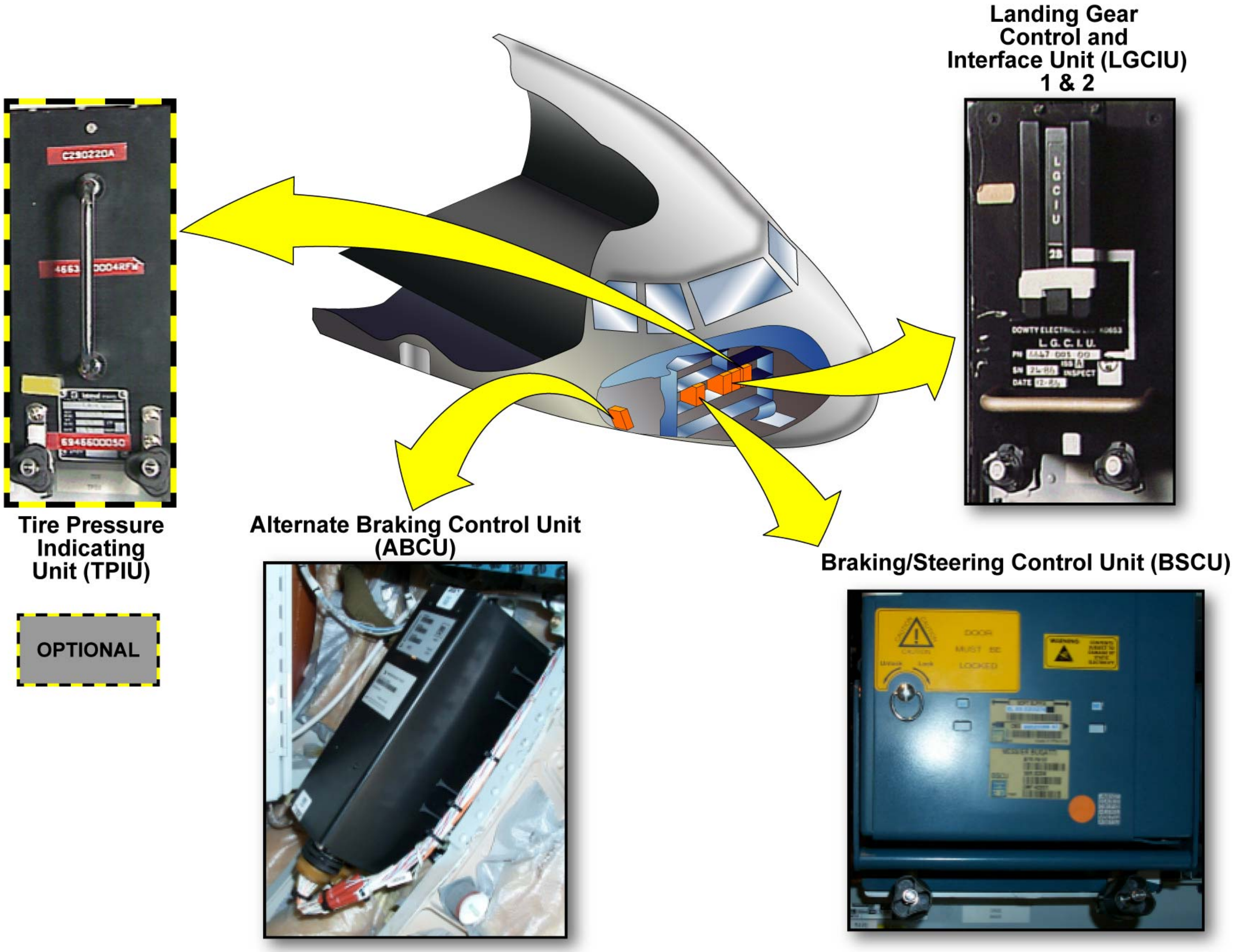
CONTROL AND INDICATING - NOSE WHEEL STEERING

U7Z08431 - U0OT4T0 - UM32PZ000000002

32 LANDING GEAR PRESENTATION (1)

COMPONENT LOCATION

The L/G computers are located in the forward avionics bay.
Note that the Tire Pressure Indication Unit (TPIU) is an option.

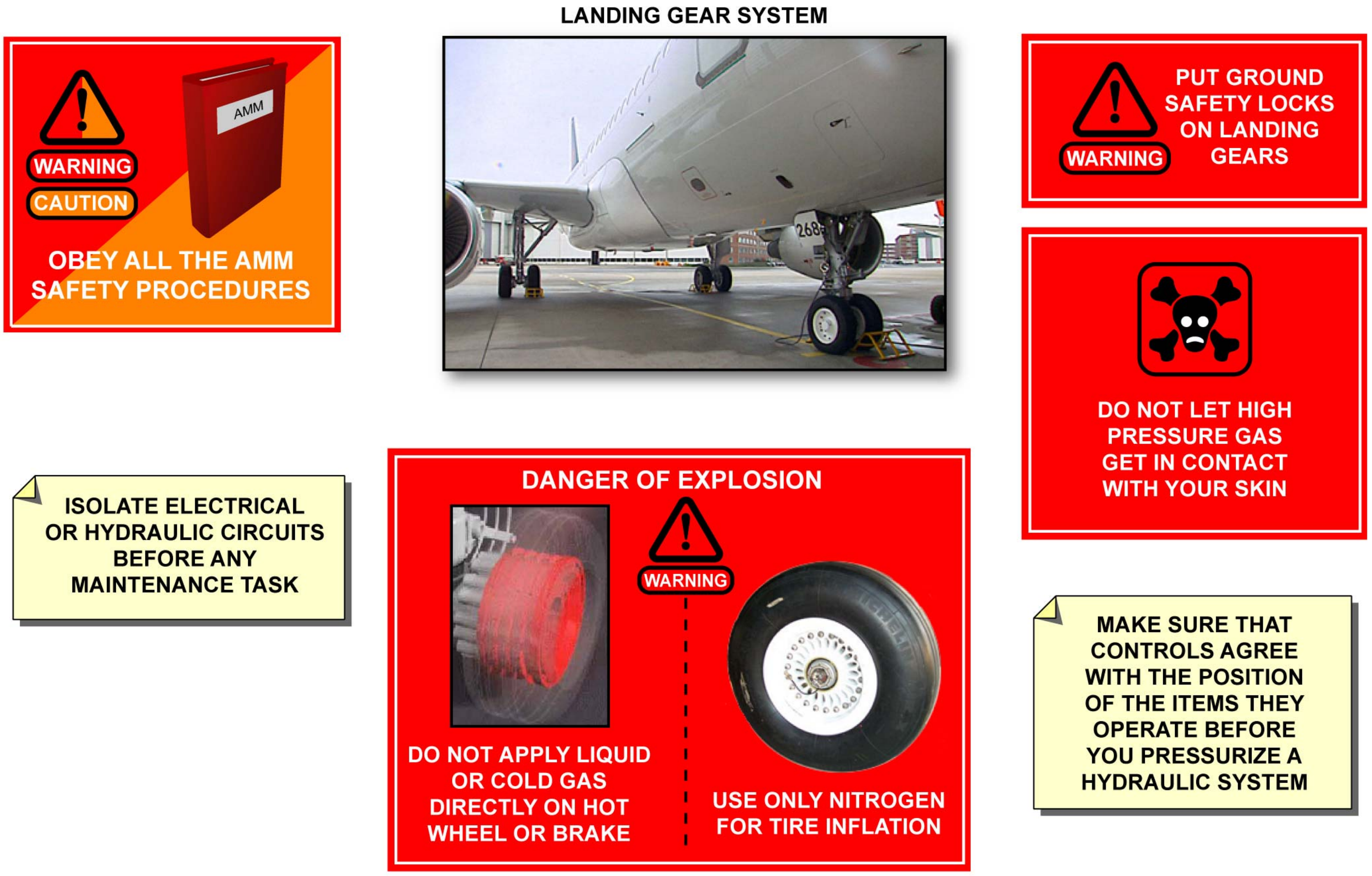


COMPONENT LOCATION

32 LANDING GEAR PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on the L/G system, make sure that you obey all the AMM safety procedures. This will prevent injury to persons and/or damage to the aircraft. Here is an overview of main safety precautions relative to the L/G system.
When you perform any maintenance task, make sure that all circuits are isolated. Unwanted electrical or hydraulic power can be dangerous.
Make sure that the L/G ground safety locks are installed.
Let the brakes and the wheels become cool before you go near the L/G.
Do not apply a liquid or gas fire extinguisher directly on a hot wheel or brake unit. This could cause an explosion.
Use only nitrogen for tire inflation. If the brakes overheat, other gases can cause an explosion.
During L/G servicing, do not let high pressure gas get in contact with your skin. Gas bubbles in your blood can kill you.
Make sure that the controls agree with the position of the items they operate before you pressurize a hydraulic system.



SAFETY PRECAUTIONS

U7Z08431 - U0OT4T0 - UM32PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

INTRODUCTION

All flight control surfaces are made of composite materials except for the slats which are made of aluminum alloy.
All flight control surfaces are electrically controlled and hydraulically operated.
As a back-up, the stabilizer and rudder is mechanically controlled and hydraulically operated.
Pilots use side sticks to fly the aircraft in pitch and roll.

FLIGHT CONTROL SURFACES

The control is achieved through the following conventional surfaces.

PITCH

Pitch control is achieved by two elevators and the Trimmable Horizontal Stabilizer (THS).
Elevators are used for short-term activity.
The THS is used for long-term activity.

ROLL

Roll control is achieved by one aileron and spoilers 2 to 5 on each wing, numbered from wing root to wing tip.

YAW

Yaw control is fulfilled by the rudder.
The rudder is used during cross wind take-off and landing, and in case of engine failure (thrust asymmetry).
The yaw damper function controls the rudder for Dutch roll damping and turn coordination.

SPEED BRAKES

The speed brake function is used in flight to increase the aircraft drag.
Spoilers 2 to 4 are used.
Roll orders and speed brake orders are added with priority given to the roll function.

GROUND SPOILERS

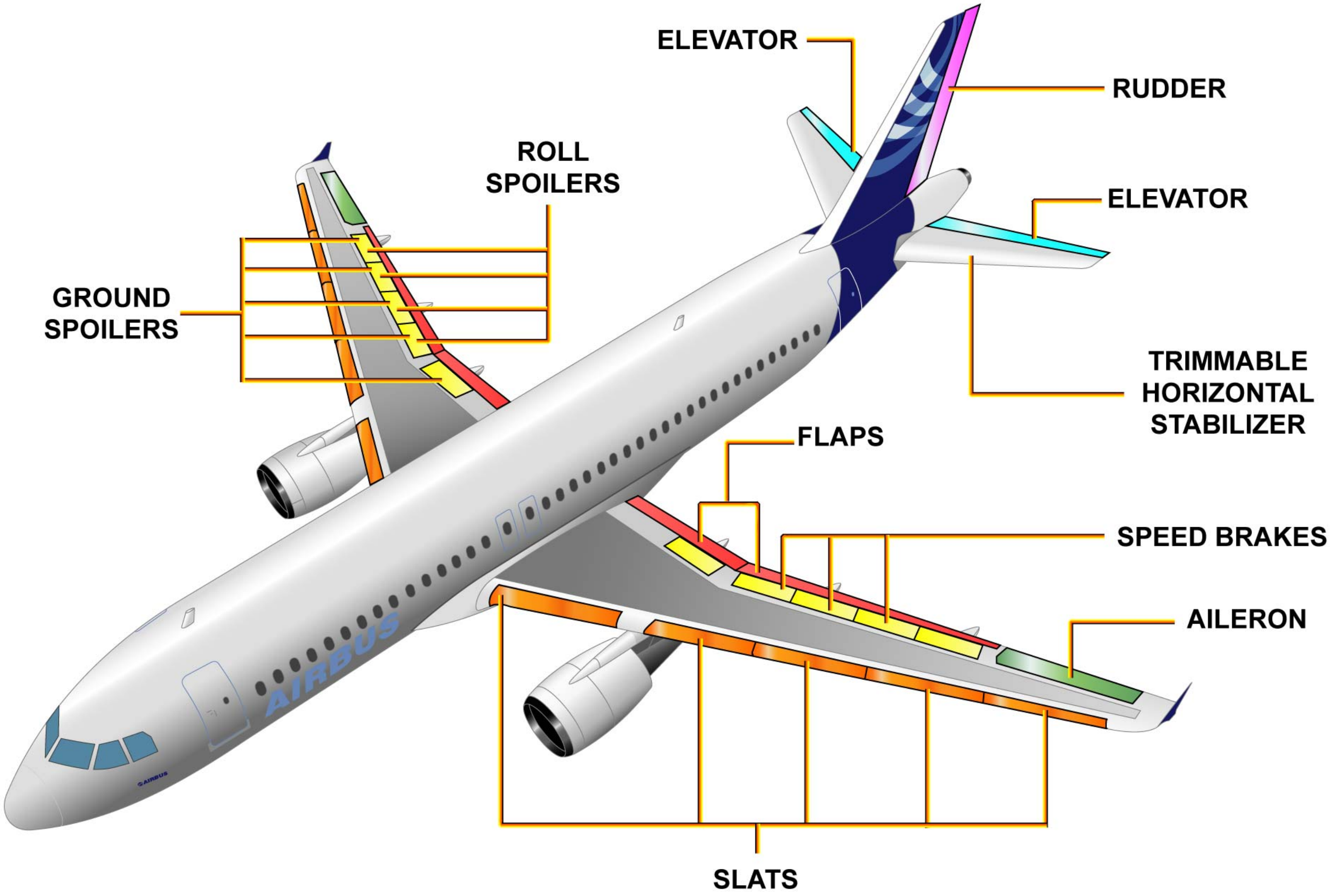
The ground spoiler function is used to destroy the lift during landing and in case of aborted take-off. All spoiler panels are used.

HIGH LIFT

The high lift function is achieved by slats and flaps.
There are two flaps, inboard and outboard, and five slats on each wing, numbered from wing root to wing tip.
The A321 is equipped with double slotted flaps.

AILERON DROOP

The aileron droop function increases the lift on the part of the wing which is not equipped which flaps.
The ailerons are deflected downwards when the flaps are extended.



INTRODUCTION & FLIGHT CONTROL SURFACES

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

CONTROLS

All the controls for the flight controls are located in the cockpit.

SIDE STICK

The two side sticks are used for manual pitch and roll control.
They are spring loaded to neutral position.
Each side stick has a push button used for autopilot disconnection and to take priority over the other side stick.

SPEED BRAKE LEVER

The speed brake lever controls the position of the speed brake surfaces and pre selection of the ground spoiler function.
For the speed brake function, the lever has to be pushed down and placed in the required position.
To arm the ground spoilers for automatic extension, the lever must be pulled UP when in the retracted position.

THS CONTROL

The THS is automatically trimmed during flight.
After touch down, the THS is automatically trimmed to neutral position.
The THS mechanical control is used to set the pitch trim before take-off or when the automatic pitch trim is not available.
Trim position is indicated in degrees on a scale adjacent to each trim wheel.

RUDDER PEDALS

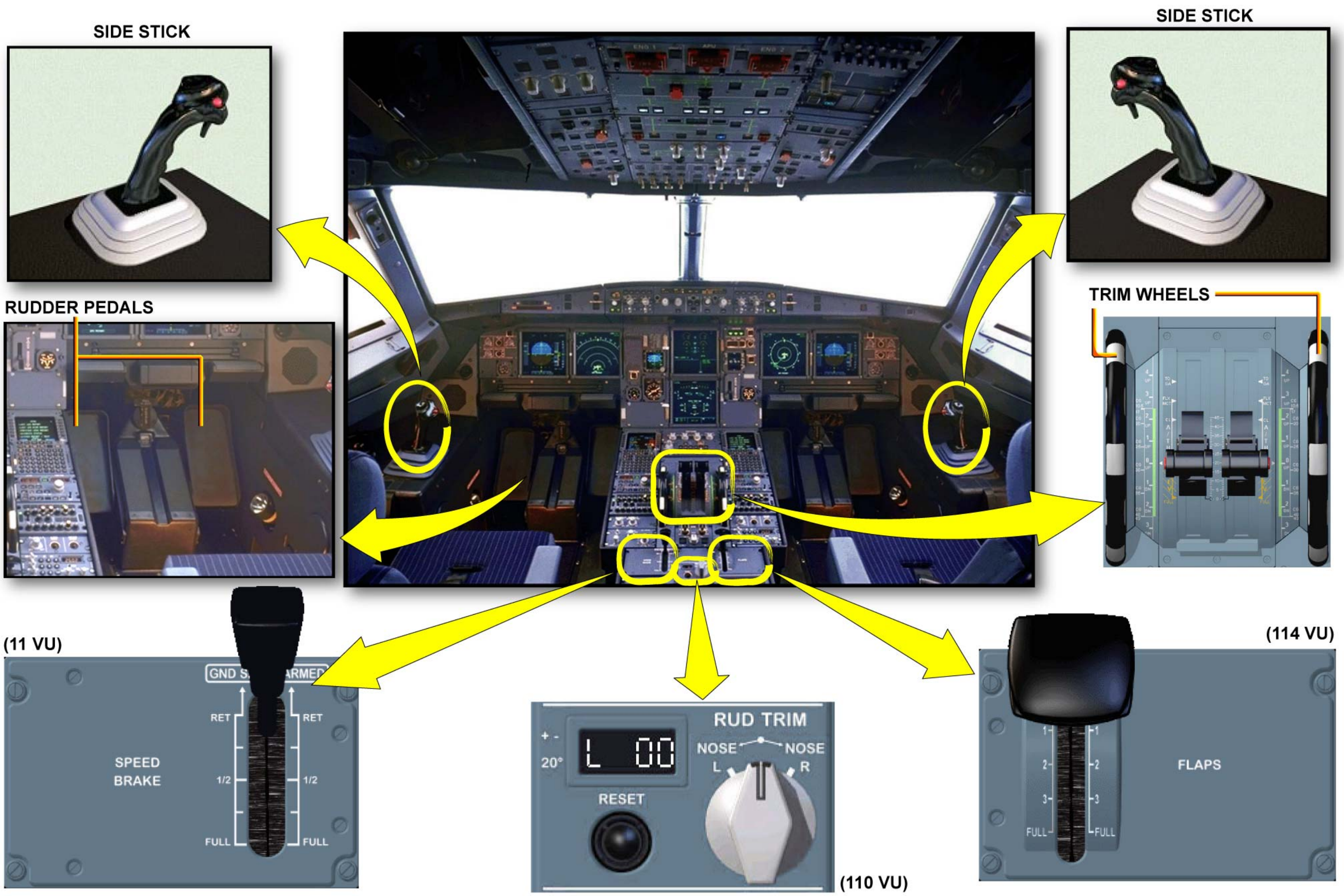
Two sets of pedals enable the rudder mechanical control.
The pedals can be individually adjusted.

RUDDER TRIM

The rudder trim control switch operates the electrical trim actuator to move the rudder to a new neutral position.
The rudder trim RESET switch resets the trim position to zero.
The rudder trim indicator displays rudder trim position in degrees.

FLAP CONTROL LEVER

The flap control lever selects simultaneous operation of slat and flap.
It has five positions.



CONTROLS - SIDE STICK ... FLAP CONTROL LEVER

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

INDICATING

All the indications for the flight controls are located in the cockpit.

FLIGHT CONTROL PANELS

The computer push buttons are used to energize, de-energize and reset the flight control computers.
FAULT or OFF can be indicated.

SIDE STICK PRIORITY LIGHTS

The side stick priority lights in front of each pilot, indicate who has taken and who has lost priority.

ECAM PAGES

The flight control system uses three ECAM pages:
- Flight control ECAM page for primary surface indication,
- WHEEL ECAM page for ground spoiler indication,
- Engine/Warning Display for slat/flap indication.

INDICATING - FLIGHT CONTROL PANELS ... ECAM PAGES

U7Z08431 - U0OT4T0 - UM27PZ000000002

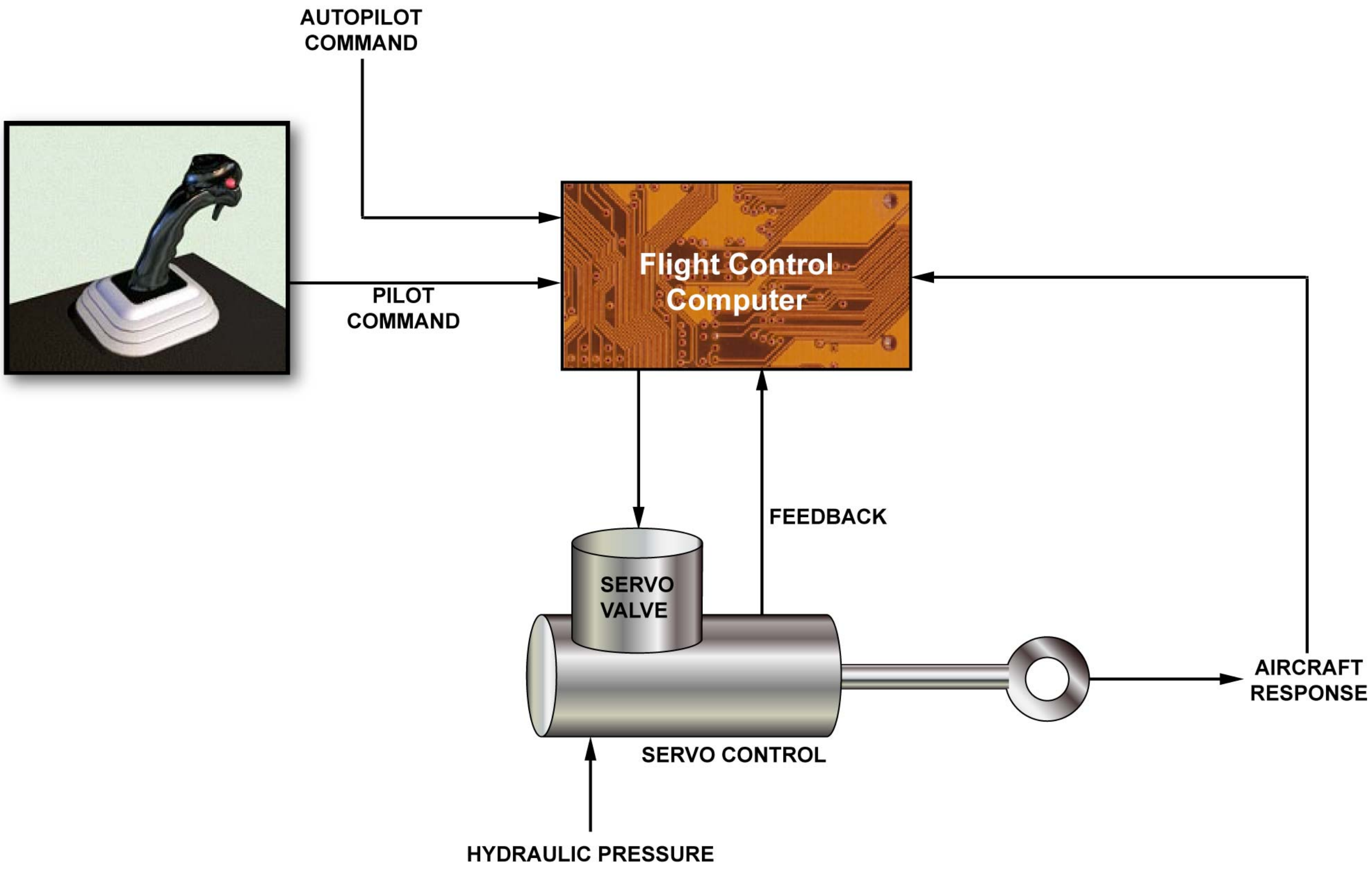
27 FLIGHT CONTROLS PRESENTATION (1)

FLY BY WIRE PRINCIPLE

The pilots use the side sticks to fly the aircraft in pitch and roll (and in yaw indirectly through turn coordination).
Computers interpret the pilot's inputs and move the flight control surfaces to follow their orders.
However, regardless of the pilot's inputs, the computer prevents:
- excessive maneuvers,
- flight outside the safe flight envelope.

Autopilot commands are given directly to the computers.

U7Z08431 - U0OT4T0 - UM27PZ000000002



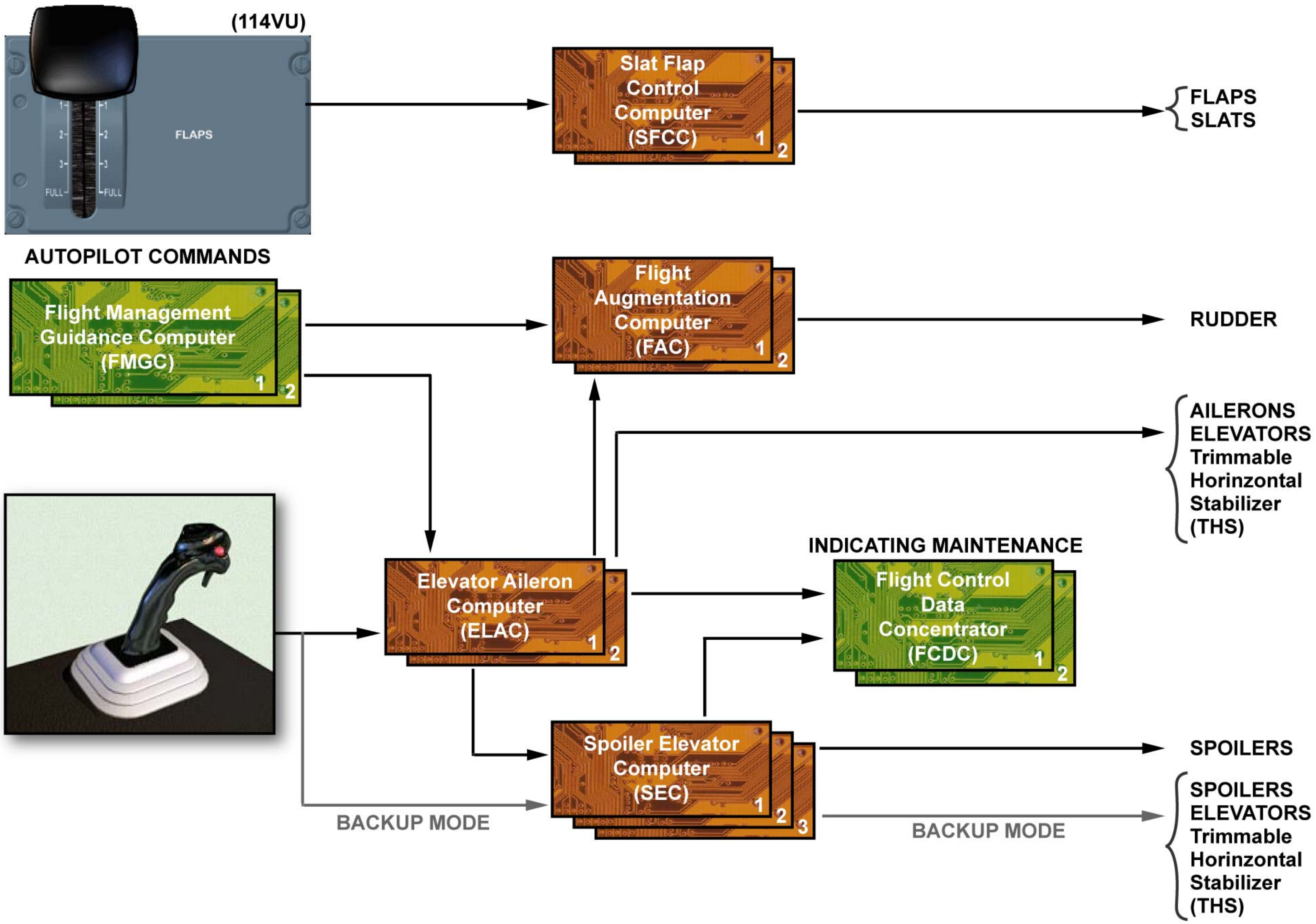
U7Z08431 - U0OT4T0 - UM27PZ000000002

FLY BY WIRE PRINCIPLE

27 FLIGHT CONTROLS PRESENTATION (1)

FLIGHT CONTROLS ARCHITECTURE

A computer arrangement permanently controls and monitors the flight control surfaces, it also records and stores faults.
This arrangement includes:
- 2 Elevator Aileron Computers (ELAC) for pitch and roll control,
- 3 Spoiler Elevator Computers (SEC) for pitch and roll control,
- 2 Flight Augmentation Computers (FAC) for yaw control,
- 2 Flight Control Data Concentrators (FCDC) for indication and maintenance tests,
- 2 Flight Management Guidance Computer (FMGC) for autopilot commands,
- 2 Slat Flap Control Computers (SFCC) for slat and flap control.



FLIGHT CONTROLS ARCHITECTURE

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

SURFACES

All the flight control surfaces are hydraulically operated by actuators which receive electrical signals from the computers. The rudder and the Trimmable Horizontal Stabilizer (THS) can also be mechanically controlled.

ACTUATORS

All the actuators are hydraulically powered by one of the three hydraulic circuits, except the rudder trim actuator, the rudder travel limitation actuator and the THS servo-motors which are electrically driven.

COMPUTERS

The relationship between actuators and computers is indicated on the schematic. The left or right elevator actuators are connected to two computers, one ELevator Aileron Computer (ELAC) and one Spoiler Elevator Computer (SEC).

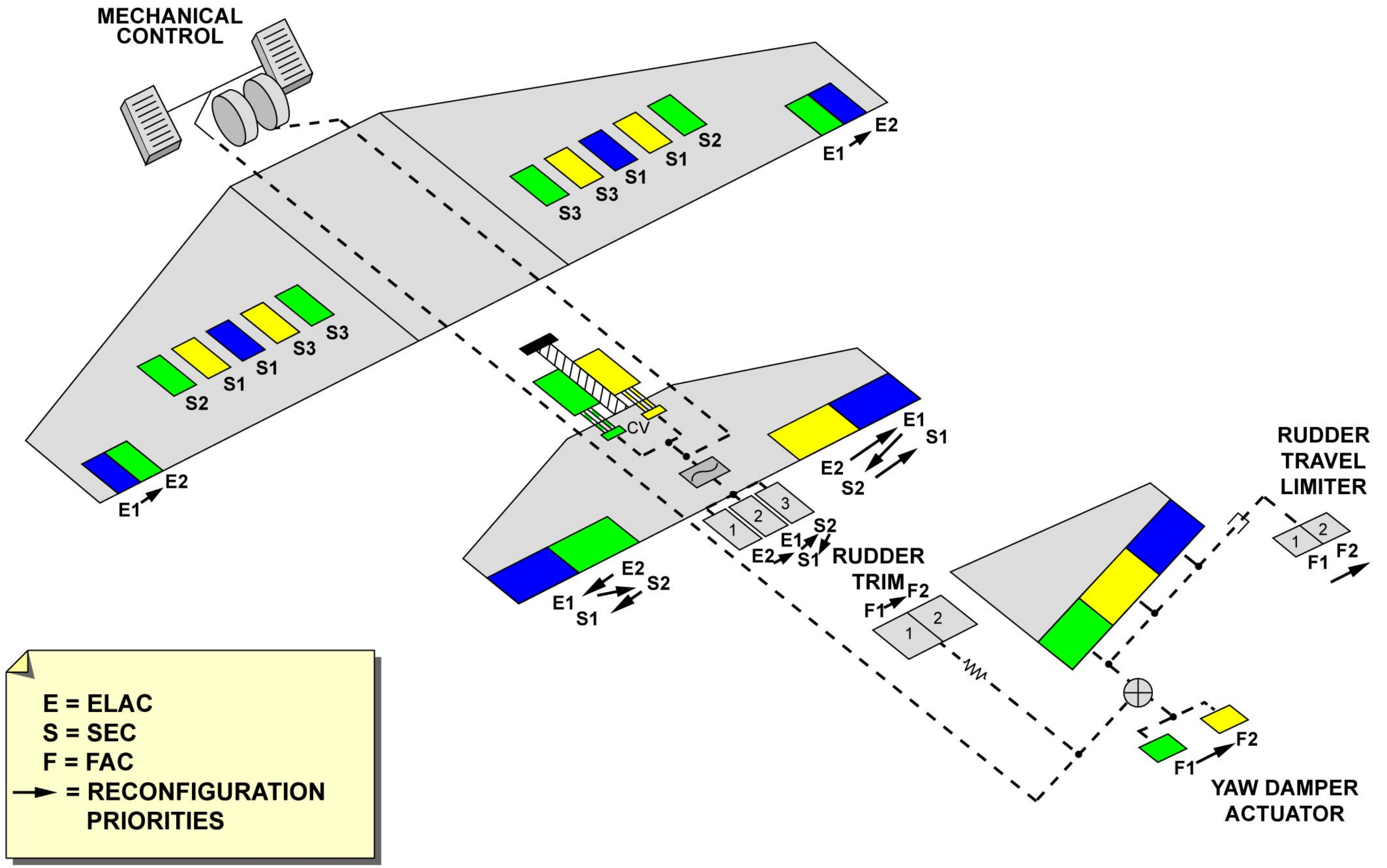
ACTIVE SERVO CONTROLS

There are two servo controls for each aileron, for each elevator and for the yaw damping function. In normal configuration, one servo control actuates the surface. It is called active servo control. The second, which follows the surface deflection, is in damping mode. When only the mechanical control of the pitch trim is available (all computers inop), the centering mode is applied to the elevators. The actuators are hydraulically maintained in neutral position.

RECONFIGURATION PRIORITIES

In normal configuration, the following computers ensure the servoloop control. The arrows indicate the actuation reconfiguration priorities in case of computer failure or loss of hydraulic circuits.

U7Z08431 - U0OT4T0 - UM27PZ000000002



SURFACES - ACTUATORS ... RECONFIGURATION PRIORITIES

27 FLIGHT CONTROLS PRESENTATION (1)

FLIGHT CONTROL LAWS

The Electrical Flight Control System (EFCS) computers convert pilot inputs into aircraft control objectives.
The computers calculate the control laws that are used to compute the surface deflections.
The system has a high degree of redundancy and it will reconfigure itself when failures occur.

NORMAL LAW

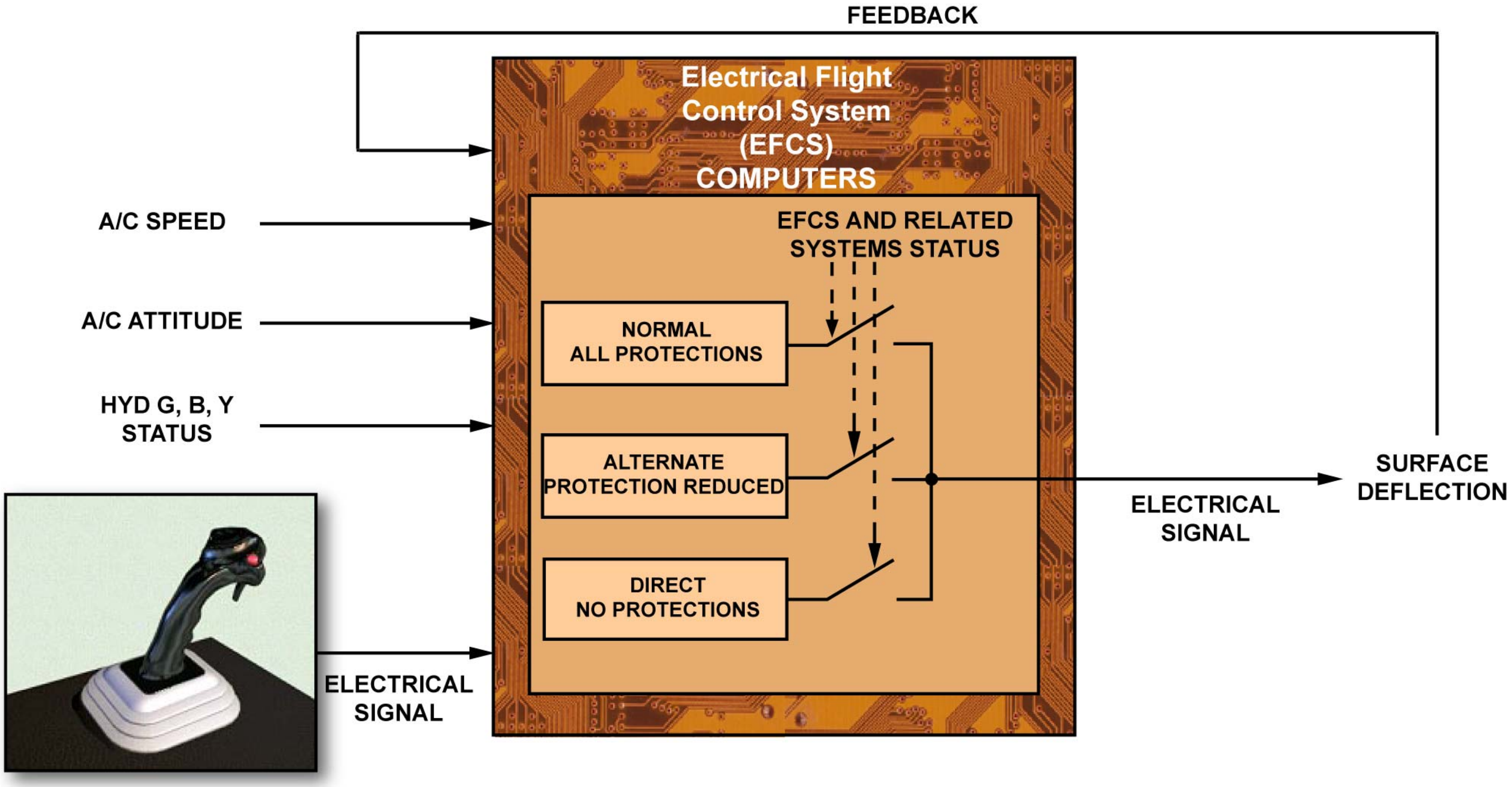
In normal condition, the normal law is used to compute the surface deflection orders.
Normal laws provide full flight phase envelope protection. This means that the aircraft will be protected from excessive maneuvers during all flight phases.

ALTERNATE LAW

The alternate law is automatically introduced as soon as the normal law is lost due to system failures.
The alternate law gives reduced protection.

DIRECT LAW

The direct law is automatically introduced when further failures occur.
In direct law all protections are lost. There is a direct relationship between the side stick orders and the surface.
The direct law is automatically activated on ground.



EFCS CONTROL LAWS SWITCH FROM NORMAL TO ALTERNATE OR DIRECT ACCORDING TO THE NATURE AND NUMBER OF FAILURES.

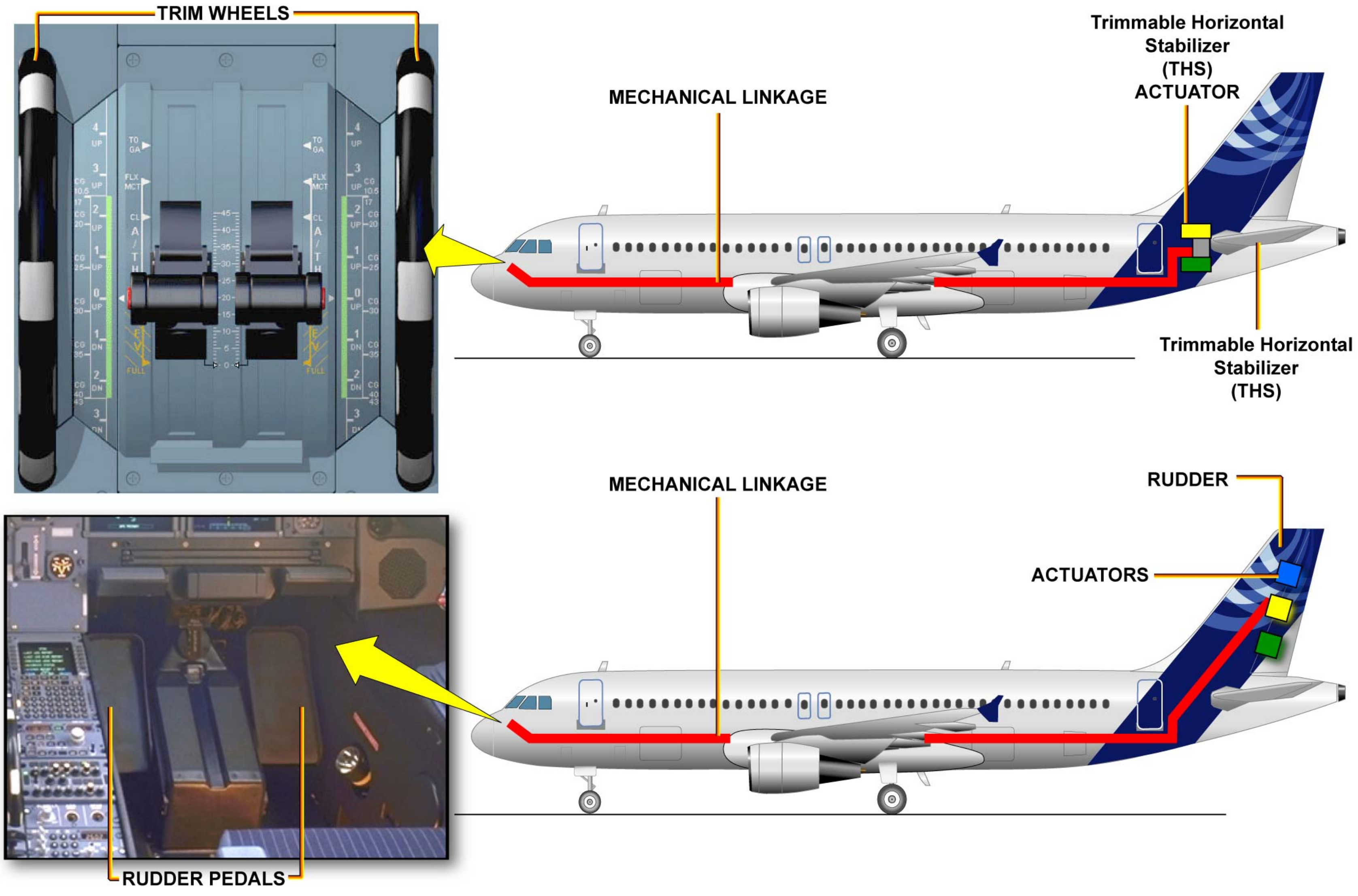
FLIGHT CONTROL LAWS - NORMAL LAW ... DIRECT LAW

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

MECHANICAL BACK-UP

The mechanical back-up lets the aircraft be controlled during a temporary complete loss of electrical power or flight controls computers.
Longitudinal control is achieved using the trim wheels to control the THS, as the elevators are kept at zero deflection.
Lateral control is achieved from the rudder pedals.
Hydraulic power is still needed to operate the surfaces of the THS and the Rudder.



MECHANICAL BACK-UP

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

SLAT AND FLAP SYSTEM

The slats and flaps are electrically controlled and hydraulically operated. Two SFCCs ensure control and monitoring. Each computer has one slat and one flap channel.
The slat and flap systems are similar.
Each system is driven by a Power Control Unit (PCU) with two hydraulic motors coupled by a differential gearbox.
Then torque shafts and gearboxes transmit the mechanical power to the actuators which drive the surfaces.
Each motor is powered by a different hydraulic system and has its own valve block and Pressure Off Brake (POB).
Valve blocks control the direction of rotation and the speed of their related PCU output shaft.
The POB locks the transmission when the slat and flap surfaces have reached the selected position or if hydraulic power fails.
Wing Tip Brakes (WTBs) are provided in order to stop and lock the system when major failures are detected. They are hydraulically activated and can only be reset on ground.
Position Pick-Off Units (PPUs) send slat and flap position feedback to the SFCCs and ECAM.
Flap sensors installed between inboard and outboard flaps inhibit further flap operation when a flap attachment failure is detected.
The signal is sent to the SFCCs via the Landing Gear Control and Interface Units (LGCIU)
To prevent an aircraft stall, slats cannot be fully retracted at high angles of attack or low speeds (Alpha/speed lock function).

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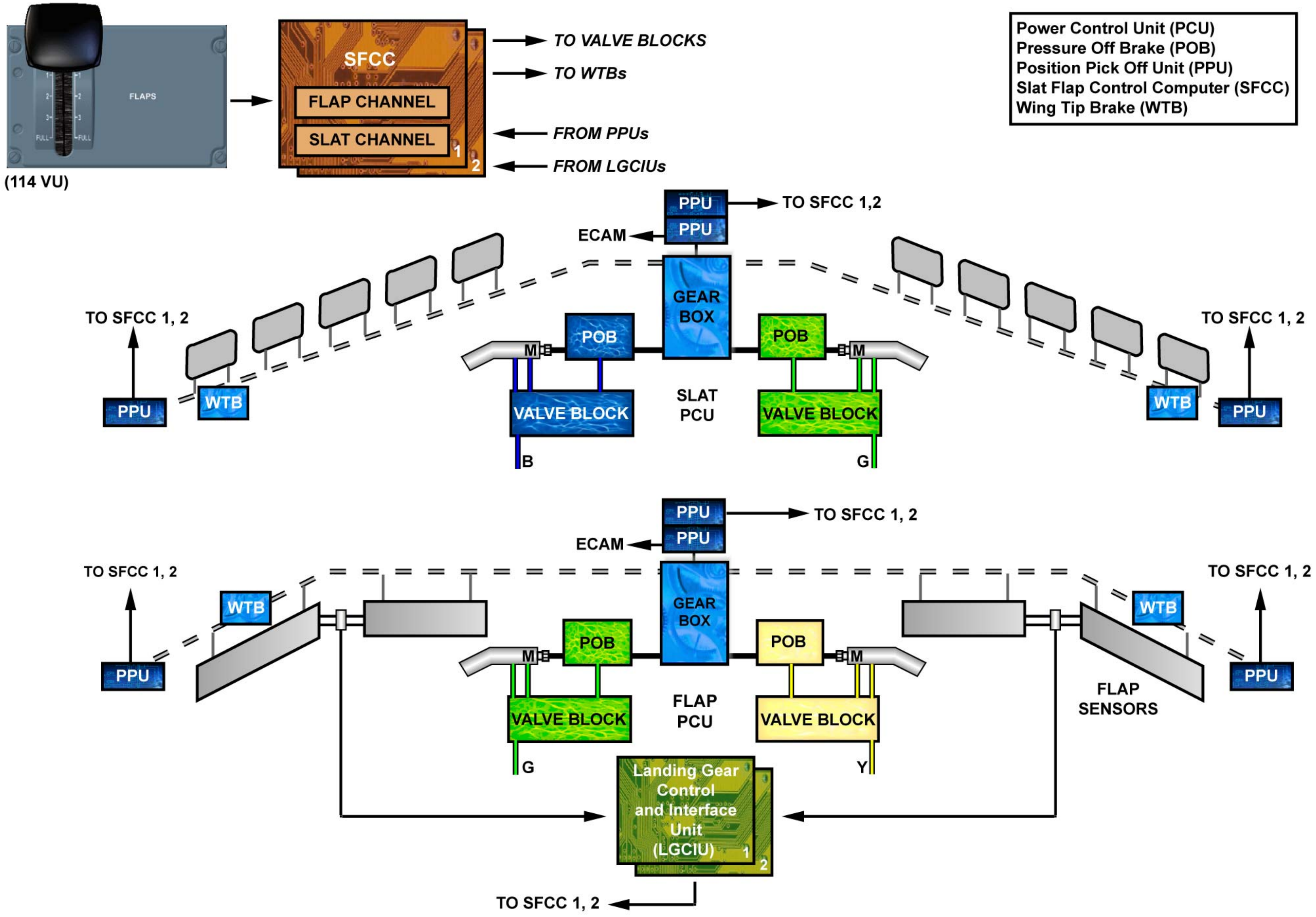


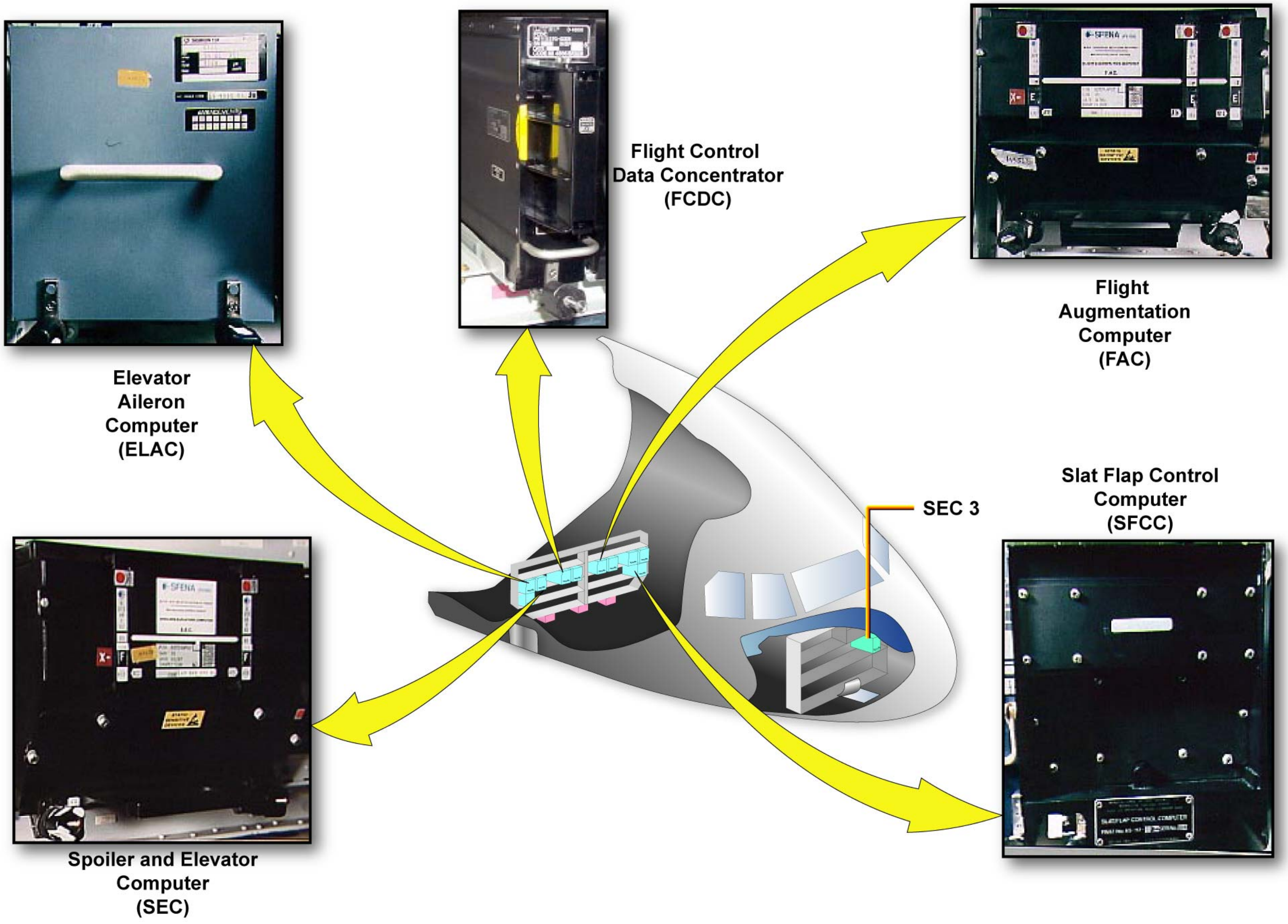
SLAT AND FLAP SYSTEM

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

COMPUTERS

All the flight control computers are located in the avionics compartment.



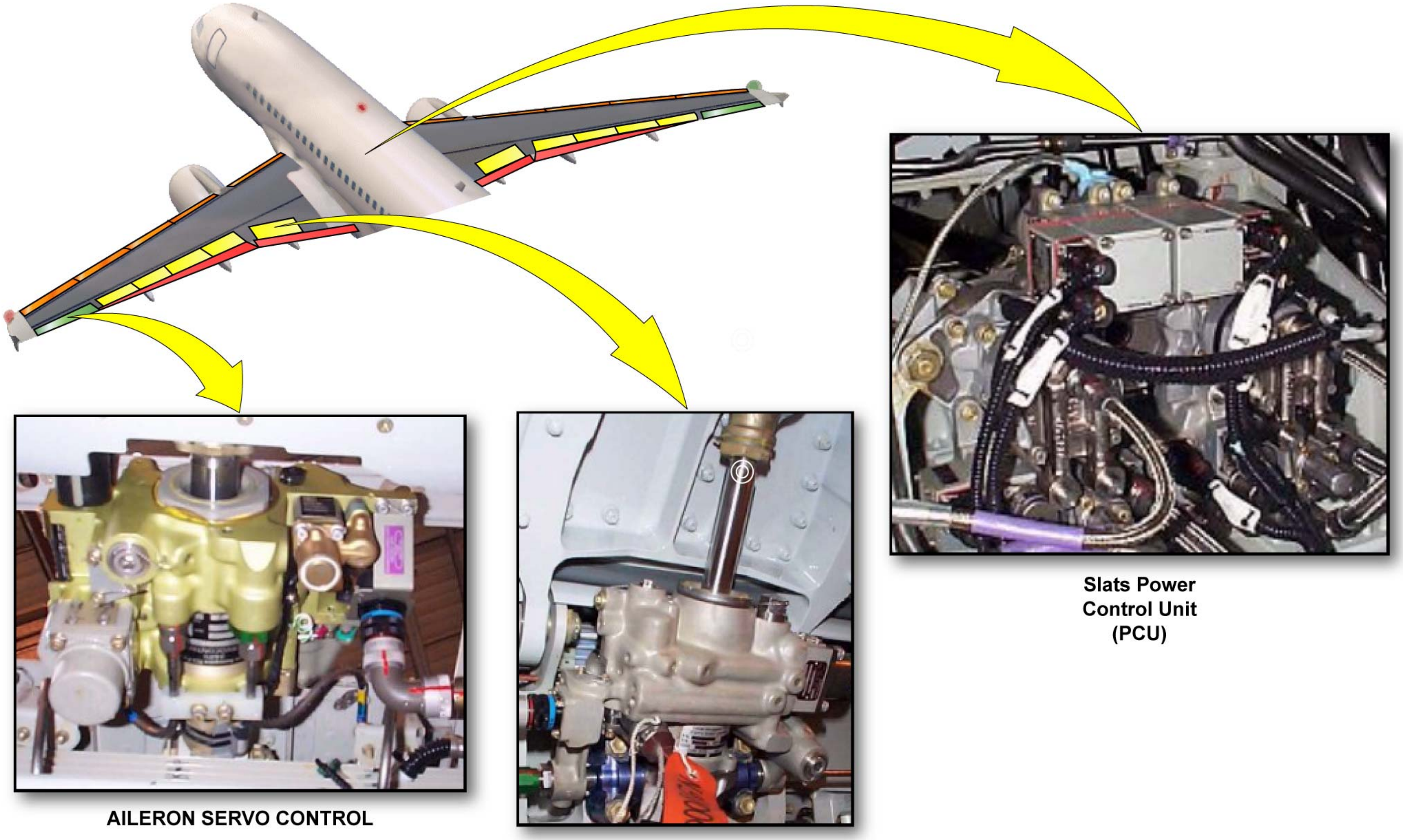
COMPUTERS

U7Z08431 - U0OT4T0 - UM27PZ000000002

27 FLIGHT CONTROLS PRESENTATION (1)

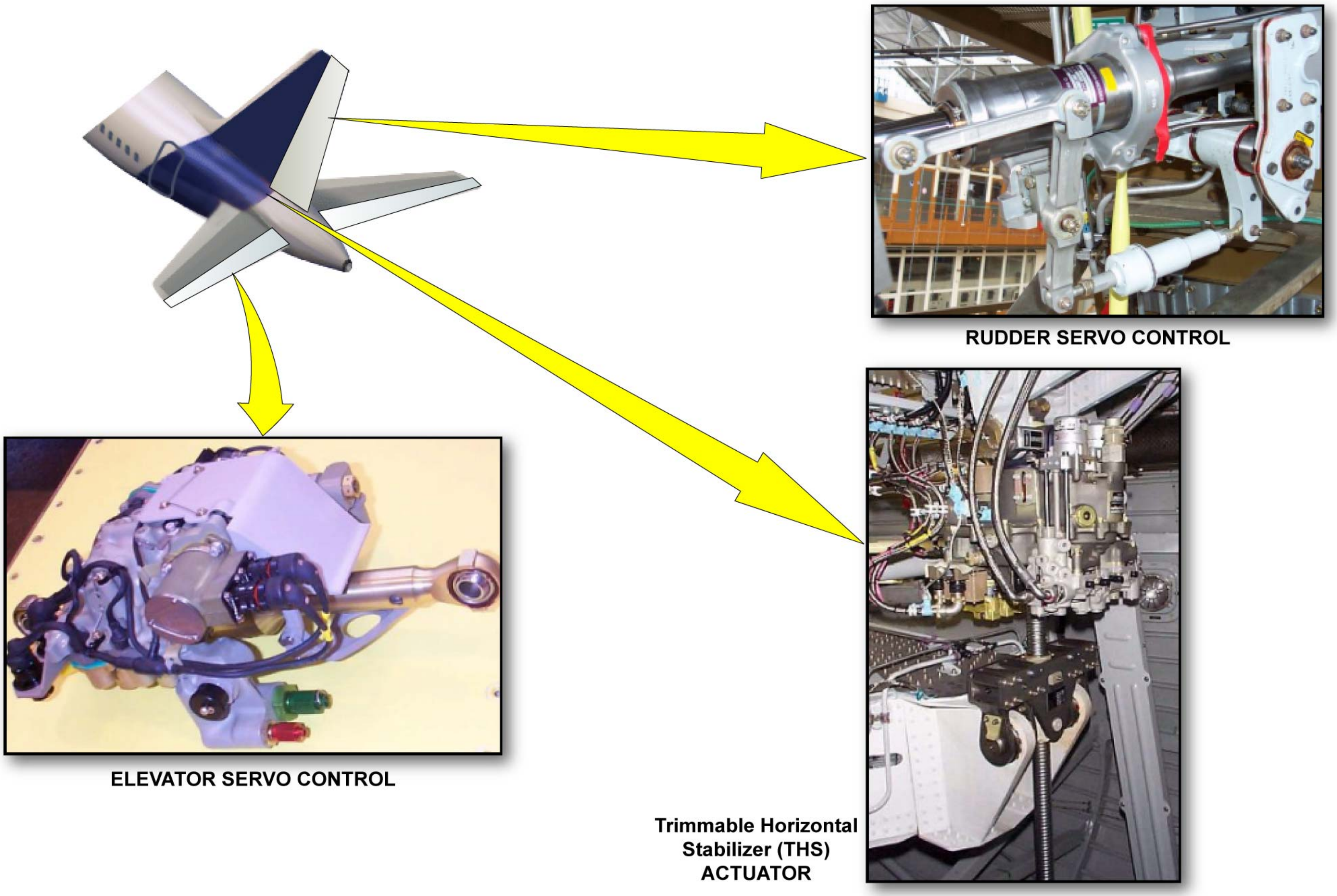
ACTUATORS

The Aileron surface is powered by two servo controls.
Each Spoiler surface is powered by a single servo control.
The Flaps and Slats surfaces are powered by their dedicated PCU.
The Rudder surface is powered by 3 servo controls.
The THS is moved by one actuator.
The Elevator surface is powered by two servo controls.



ACTUATORS

U7Z08431 - U0OT4T0 - UM27PZ000000002


RUDDER SERVO CONTROL
ELEVATOR SERVO CONTROL
Trimmable Horizontal
Stabilizer (THS)
ACTUATOR

ACTUATORS

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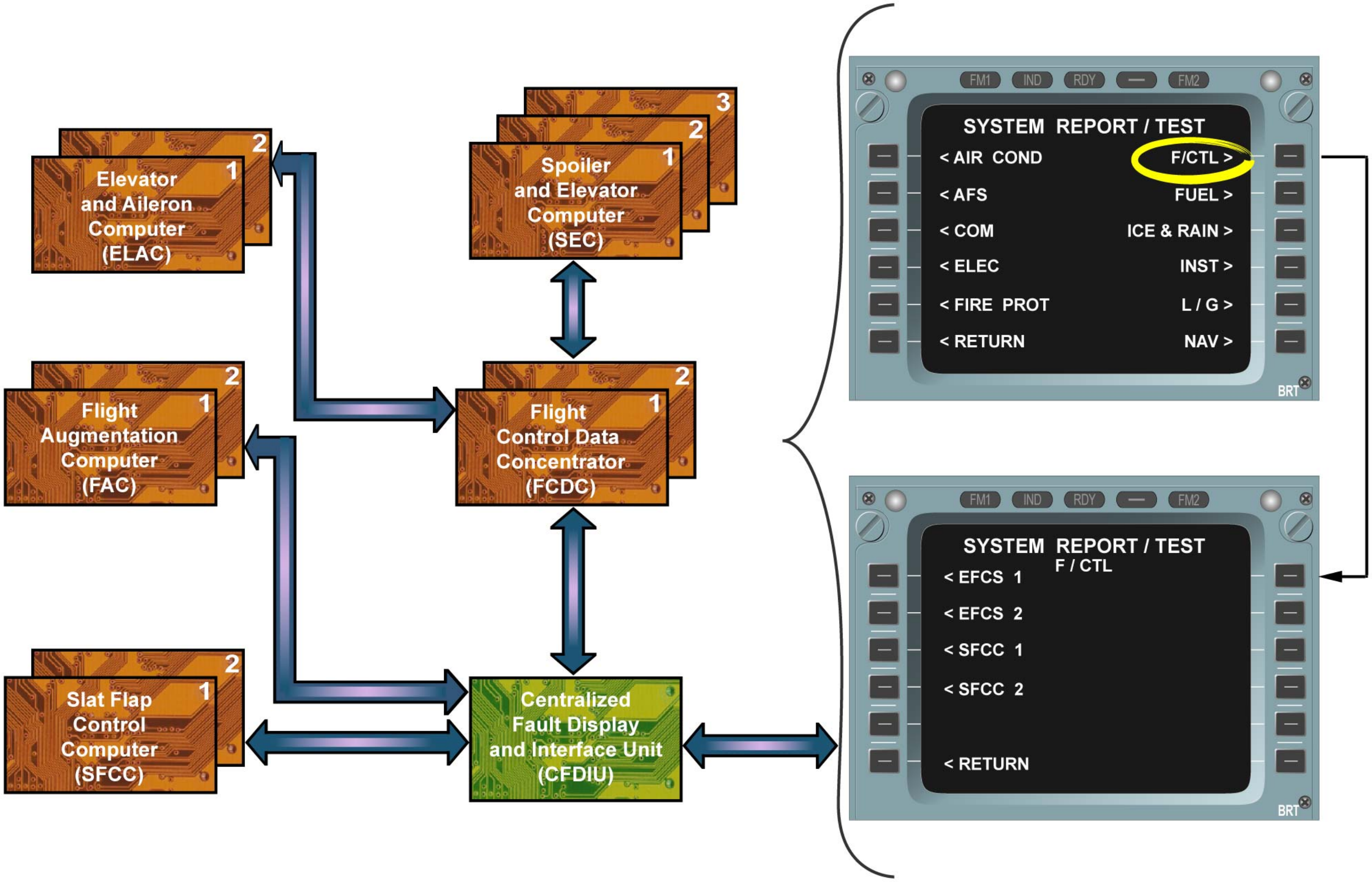
27 FLIGHT CONTROLS PRESENTATION (1)

MAINTENANCE TEST FACILITIES

All computers in the flight control systems can be tested via the MCDU.

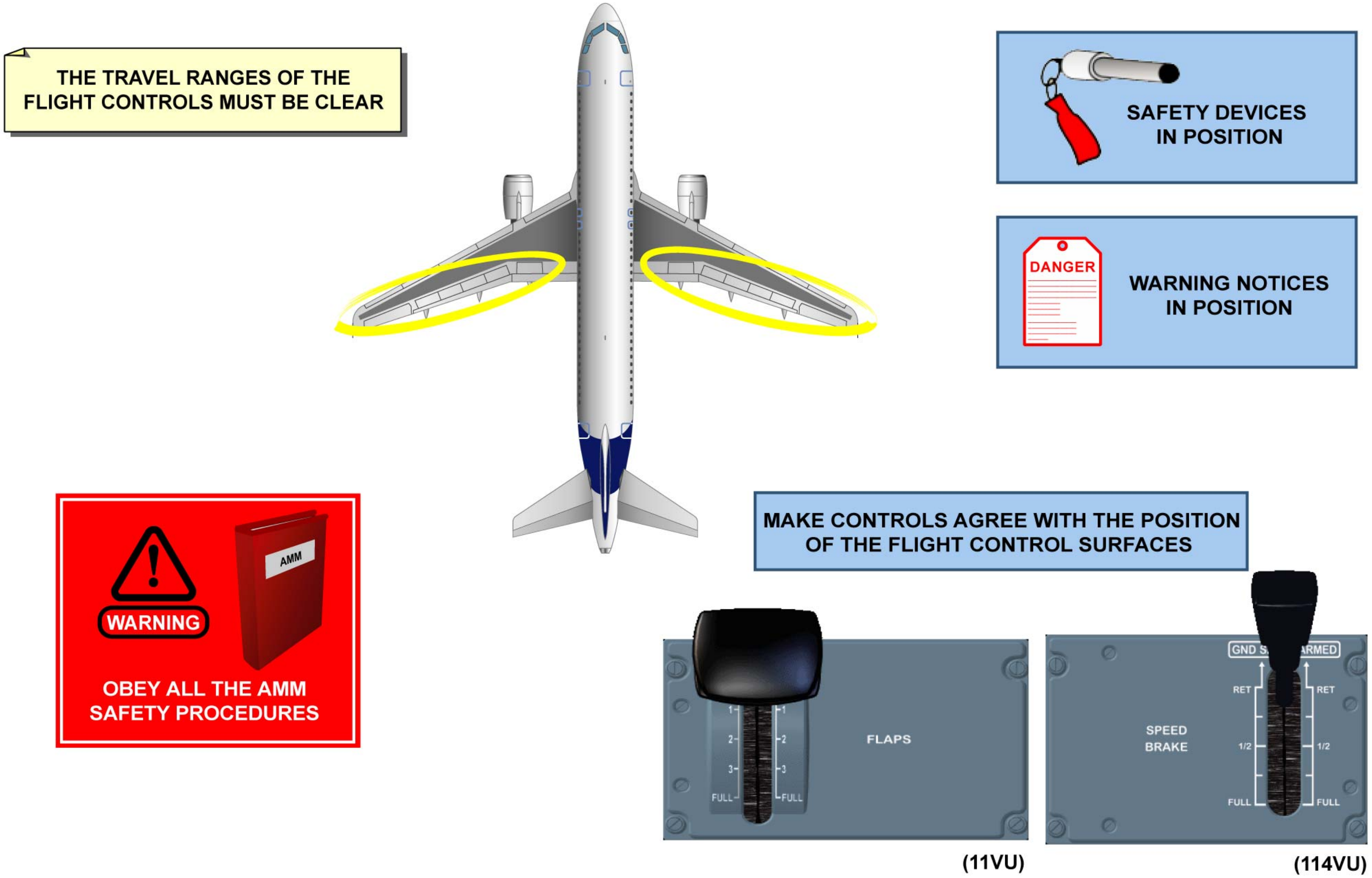


MAINTENANCE TEST FACILITIES

27 FLIGHT CONTROLS PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on flight controls, make sure that you obey all the AMM safety procedures. This will prevent injury to persons and /or damage to the aircraft.
Put safety devices and warning notices in position before you start a task on or near flight controls.
Make sure that the controls agree with the position of the flight control surfaces before you pressurize hydraulic system.
Make sure that the travel ranges of the flight control surfaces are clear.
Movement of flight controls can cause injury to persons and/or damage to the aircraft.



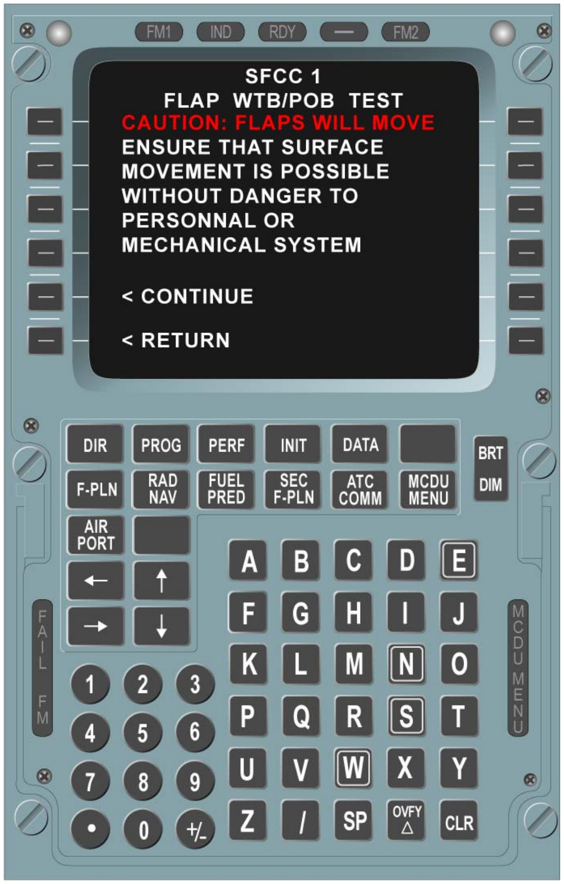
SAFETY PRECAUTIONS

27 FLIGHT CONTROLS PRESENTATION (1)

SAFETY PRECAUTIONS (continued)

DYNAMIC TESTS

When you perform operational tests, the flight control surfaces move.



SAFETY PRECAUTIONS - DYNAMIC TESTS

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